Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

May, 1936

Immediate Steel

Accurately Sheared Sheets

Intricate parts are quickly flame cut from heavy plates

Ryerson Abrasion Resisting Steel Sheets and Plates

Sheets and plates of a steel developed expressly for abrasion resistance. They last many times longer than ordinary steel yet are moderate in price. We can furnish them plain, or bent, perforated, punched or formed to your specifications. Write for bulletin giving complete data.

Perforated Sheets and Plates

We are prepared to furnish sheets and plates with all standard types of perforations. Two types are regularly carried in stock. See the Ryerson Stock List.

Other Steel Products

Ryerson stocks include practically everything in steel and allied lines.

Cold Finished Shafting
Beams and Heavy Structurals
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Stainless Steel
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Extra Wide Cold Finished Flats
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Heat Treated Alloy Steel Bars
Boiler Tubes and Fittings
Welding Rod—Mechanical Tubing
Rivets, Bolts, Nuts, Washers, Etc.
Concrete Reinforcing Bars
Babbitt Metal and Solder

WRITE FOR STOCK LIST

Steel in Stock for the Rock Products Industries

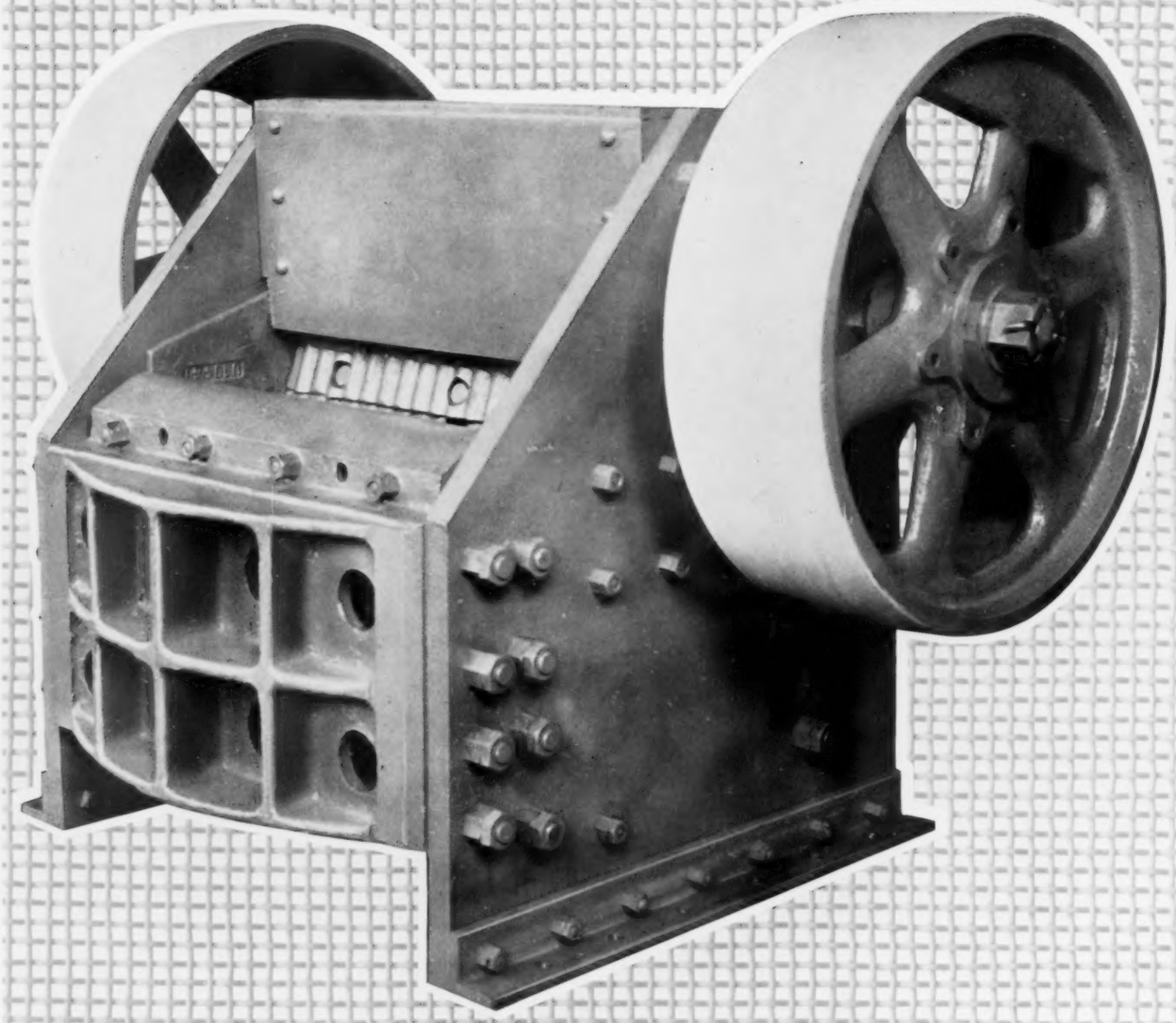
WHEN something breaks or when construction or extensions are necessary, you can depend on immediate shipment of the steel from a nearby Ryerson plant. More than 10,000 sizes and kinds of steel and allied products are carried in stock. If you desire it, experienced workers will quickly cut, bend, punch or form the material to your specifications.

There are ten Ryerson plants ready to serve you. When you need steel a phone call, wire or letter will start it on the way to you at once.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Detroit, Boston, Buffalo, Philadelphia, Jersey City

RYERSON

★ Pages 43-49



Here's a crusher with guts . . . . . and that's what a quarryman wants!

GOOD ROADS MACHINERY CORPORATION
South Station
KENNETT SQUARE, PA.

Good Roads MACHINERY

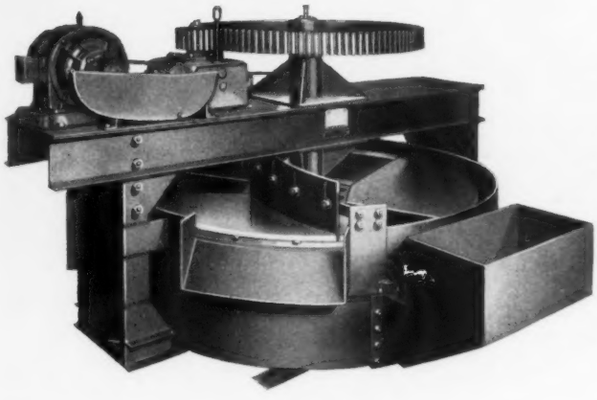
CHAMPION
Roller-Bearing
CRUSHERS

Large jaw openings . . . Long crushing jaws...Primary and secondary crushing in a *single unit* . . . One-man stone reduced in one operation to very small sizes . . . IN UNUSUALLY LARGE CAPACITY

Sand

THAT MEETS THE NEWER SPECIFICATIONS -- PRODUCED WITH THE

Rotoscoop



THE trend is towards cleaner, more uniform sand, of greater fineness—some specifications being written today, require from 10 to 25% of -50 mesh, and 2 to 15% of -100 mesh sand.

The Link-Belt Rotoscoop provides a simple method of recovering fine grains formerly lost in the overflow water —discharging dry enough for truck transportation.

The volume of fines and grading can be easily varied to suit requirements.

The Rotoscoop is a self-contained unit requiring low headroom, and minimum space and foundations; also little power. Can be fitted-in to take the overflow from present sand units, or to replace them. Send for Folder No. 1463.

5472

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The Leading Manufacturer
of Equipment for Handling Materials and Transmitting Power

CHICAGO PHILADELPHIA INDIANAPOLIS
ATLANTA SAN FRANCISCO TORONTO

Offices in Principal Cities

The Rotoscoop is made in four sizes: 15 ft., 12 ft., 9 ft., and 6 ft. diameters, with capacities ranging from 20 to 150 tons an hour, based on material weighing 100 lbs. per cu. ft.

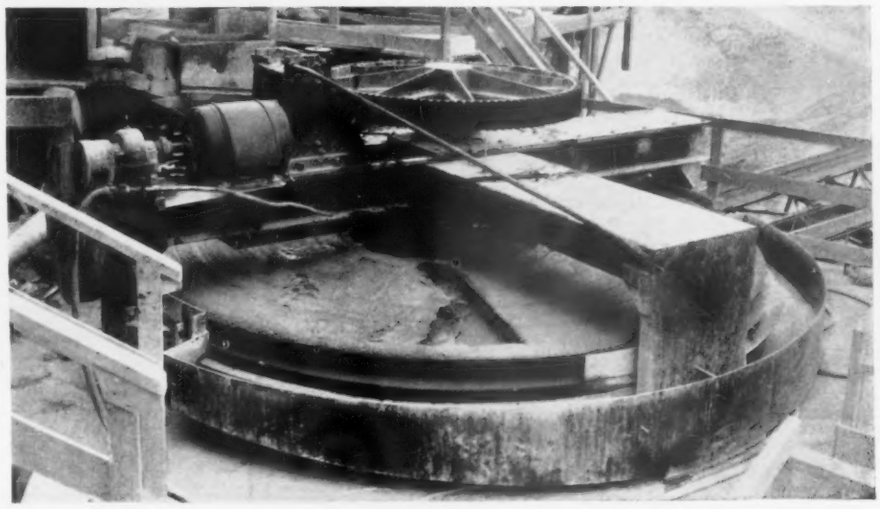
Link-Belt makes a complete line of sand dewatering devices, including screw and log washers, conical separators, dewatering flight conveyors, and the Shaw classifier. Link-Belt engineers will be glad to look into your operating conditions and recommend the right unit for your work.

•

The illustration to the right is of a 15 ft. diam. Link-Belt Dewatering Rotoscoop handling crushed limestone sand at Norris Dam (T.V.A.), Norris, Tenn.

Another user has recently written, "We are proud of the Rotoscoop; our sand has been running 18% passing a -50 mesh screen—we figured the deposit would run from 12 to 15% passing."

LINK-BELT



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SEP 28 1936

Pit and Quarry

With which is consolidated
CEMENT-MILL & QUARRY

Volume 28 May, 1936 Number 11

Published on the tenth of each month for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other nonmetallic minerals. Entered as second-class matter November 28, 1932, at the Postoffice at Chicago, Ill., under the Act of March 3, 1897.

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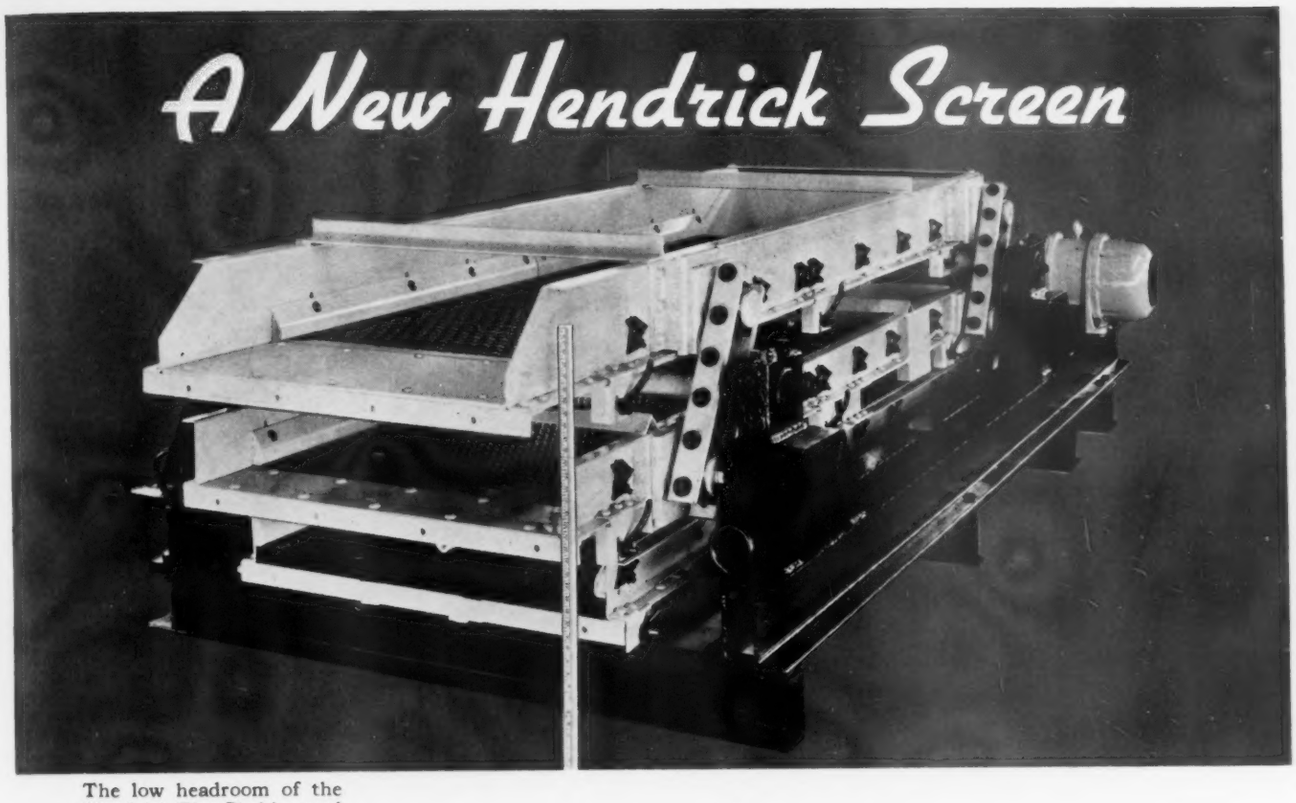


The low headroom of the Hendrick Flat Shaking and Whipping Screen is illustrated by the yardstick shown above.

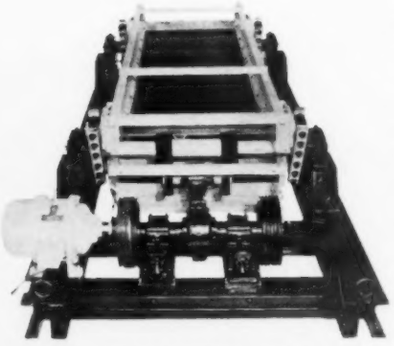
SHAKING & WHIPPING
AT THE SAME TIME ON A LEVEL PLANE

A new action . . . shaking and whipping . . . never before combined in one unit . . . is the reason for the thorough, efficient screening, and large capacity of the new Hendrick Flat Shaking and Whipping Screen. In its perfectly balanced, rugged construction, free of destructive vibration, there is ample strength for the most strenuous service. At medium speed, with a short stroke, it operates between 350 and 400 r.p.m.

The Hendrick Flat Shaking and Whipping Screen can be installed on any flat foundation avoiding the expense of erecting special inclined supports; or it may be suspended from overhead. Its unusually low headroom will permit the use of locations with low ceilings which would preclude a higher screen. Time and labor-saving, patented Hendrick "hold-down" hooks permit speedy and convenient changing of the screen plates.

To insure the longest possible periods of uninterrupted service, the eccentric is equipped with a heavy duty, completely enclosed, spherical roller bearing. And all other bearings, made of hard phosphor bronze, are grease lubricated which excludes dust, dirt and water.

The Hendrick Flat Shaking and Whipping Screen can be furnished in two or three deck construction . . . built 3, 3½, 4 or 5 feet wide . . . in any desired length up to 20 feet. Write for additional information.



The Hendrick Flat Shaking and Whipping Screen is protected by patents numbers, 1,979,791, 2,004,562, 2,009,-219 and patent applied for.

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For almost a century Roebling has specialized in the making of wire to meet exceptionally severe requirements as to strength, vibration, and abrasion...wire used in products ranging from giant bridge cables to shovel rope.

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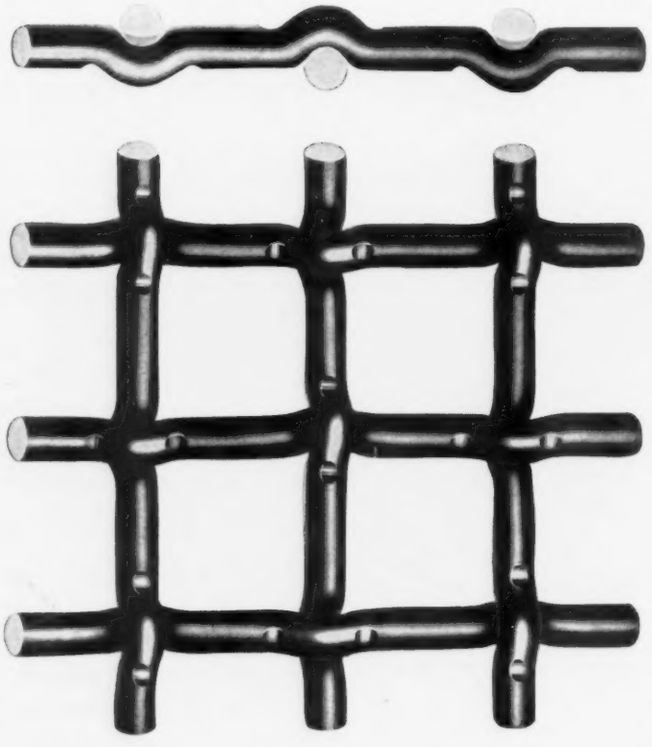

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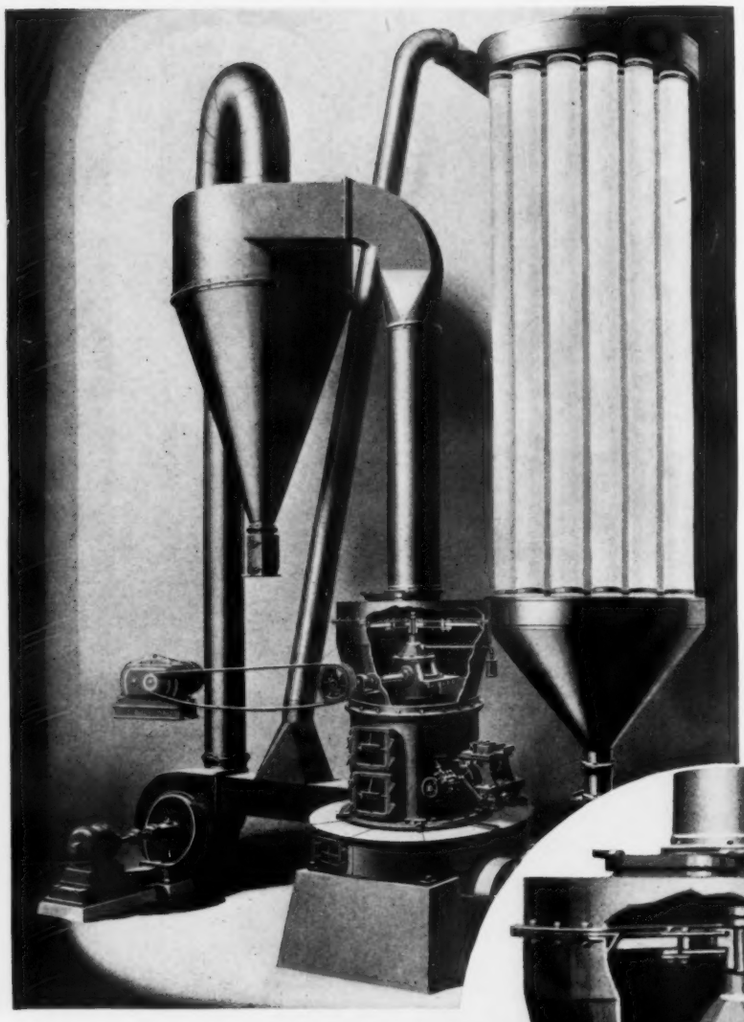
with Patented WHIZZER Separator



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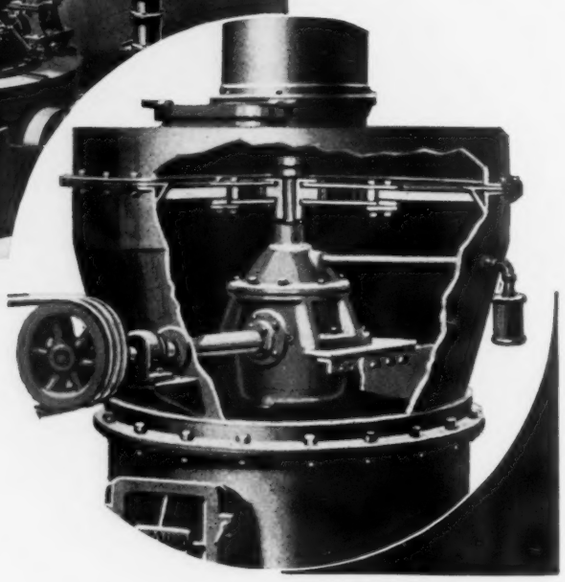
WIDE RANGE FINENESS, from 80% minus 100-mesh to 99.95% minus 325-mesh. P.I.V. Control on whizzer drive provides for infinite changes of speed in regulating classification.

EXTRA HIGH CAPACITY in fine grinding. Use of whizzer separator shows increases of 25% to 50% on harder materials, and up to 100% on softer materials, as compared to output from standard types of mills.

Over 50 new installations in past two years. Reports reveal unusual economies. Investigate the advantages of this modern mill for grinding limestone, clays, oxides, pigments and similar materials.



Close-up view of revolving whizzer in the separating chamber

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The Customer Can't be Wrong— read these user reports!

The excerpts printed below from letters received from all over the country are typical of the comments we get daily from users of AMSCO Nickel Manganese Steel and AMSCO #459 and #217 Welding Rods.

A Welding Shop in Dixon, Illinois

"In answer to your letter of December 31, 1935, will say we have tried your hard surfacing rods and as far as we have gone have found them very satisfactory.

"Have been thinking of standardizing on your hard surfacing rods.

"We also find the prices very reasonable."

A Fire Brick Company in San Francisco, California

"We tried out the #217 hard facing rod you sent us on the scraper points used in our dry pan. These points are of special iron, a replaceable wearing shoe. We had sufficient rod for one shoe.

"The hard facing stood the wear exceptionally well, better than any we have tried in that service. It showed about twice the wear-resistance of the special alloy iron."

An Aluminum Ore Operation, North Carolina

"In response to your letters of December 19th and January 24th relative to AMSCO #459 and #217 Welding Rod samples which you forwarded to us for trial, we wish to advise that our Master Mechanic reports that he found these rods to be very good on the jobs on which they were used and they applied very easily with our electric welder. He further states that they are superior to rods previously used and that when he is again in need of any of these particular rods, it is his intention to requisition these particular grades."

A Prospect in Warfield, Kentucky

"Your #459 hard metal came through the test O.K. I find that deposits from it on soft iron will cut glass and it has several times the life of the hardest steel with good shock resistance."

A Blacksmith and Machine Shop in Fort Scott, Kansas

"In regard to results we have had with your #459 hard surfacing material, we find that it works equally as well as 'A' or 'B' (two widely advertised and more expensive hard-facing rods) and, of course, it is much cheaper. We are not using much of this type of material at present, but when more is needed, you can count on an order."

The Master Mechanic of a Kentucky Refractories Concern in March, 1936, took the four knives he had hard-surfaced out of their brick machine. There was one knife hard-surfaced with AMSCO #217, one with AMSCO #459, one with X and one with XX, the two latter well-known and more expensive hard-surfacing materials.

It was found that the knife surfaced with AMSCO #217 and the knife surfaced with #459 were slightly worn, with the one hard-surfaced with #217 showing somewhat better than the one with the AMSCO #459. The knife on which X was used was worn badly, and the one that was hard-surfaced with XX was the worst one of the four. Results of the test show that AMSCO #217 is the best, with #459 following closely on its heels, with X in third place, and XX running a bad last place.

These knives were hard-surfaced and put into operation about December 1, 1935.

From An Eastern Forest Service Station

"The coated manganese nickel rod has been found very satisfactory for building up jobs as it is tough and is found to have strong resistance to breakage.

"We are using #459 almost exclusively for hard surfacing and are well pleased with it. It stands up well on ripper and shovel teeth which, as you know, are subjected to rough usage in this country for moving ledge rock and boulders."

From An Iowa Manufacturing Company

An Iowa concern makes repointers for plow shares which, of course, represent an alternative method to hard-surfacing; but you will note from the following quotation from their letter that they have found the #459 rod very satisfactory on their reclaiming units:

"We wish to tell you that our Illinois representative is finding welding shops most receptive to your #459 hard-surfacing rod and many users have reported successful results when using it as a wash over the points of our reclaiming units."

Says a Welding Supply Concern in Austin, Texas

"Referring to the AMSCO Nickel Manganese Steel Welding Rod, wish to state that we did not get an opportunity to try this rod until last week, when we welded a two and one-half yard manganese steel bucket front which was broken for about twenty-six inches between the two middle teeth. Someone else had welded same with plain steel rod and, of course, it did not hold long enough to start same in service. We had to cut out all of the old weld, which necessitated cutting an unusually wide "V" but, by welding with your rod and according to your instructions, the job came out fine and the bucket is back in regular service."

A manufacturer of small shovels located in Indiana has written us as follows in connection with our AMSCO Hard-Surfacing Welding Rod:

"Regarding the tipping of the first set of teeth with your #459 hard-surface material, wish to state that we placed three of these teeth on our shovel with two old ones that were surfaced with a more expensive material, and on examining them today after 8 days running, we were surprised to find yours were out-wearing the others, and we want prices and all information on your #459."

A commercial welder located out in Idaho has the following to say about our product:

"I have done several good jobs using your AMSCO #459. I think among the list one stands out preeminently. Thus says one of my customers: 'I had been having my beet cultivator teeth pointed with new tips every year for several years. Then I tried them hard-pointed with AMSCO #459. These teeth, judging by present wear, will now last at least 4 years'."

If you have a salvage or maintenance problem on manganese or carbon steel, rolled or cast parts, weld them with AMSCO Nickel Manganese Steel Welding Rod (U. S. Patent 1815464). If it is a hard facing job, use AMSCO #459 or #217 Hard Facing Rod.

Free samples are available to those who have not used them before.

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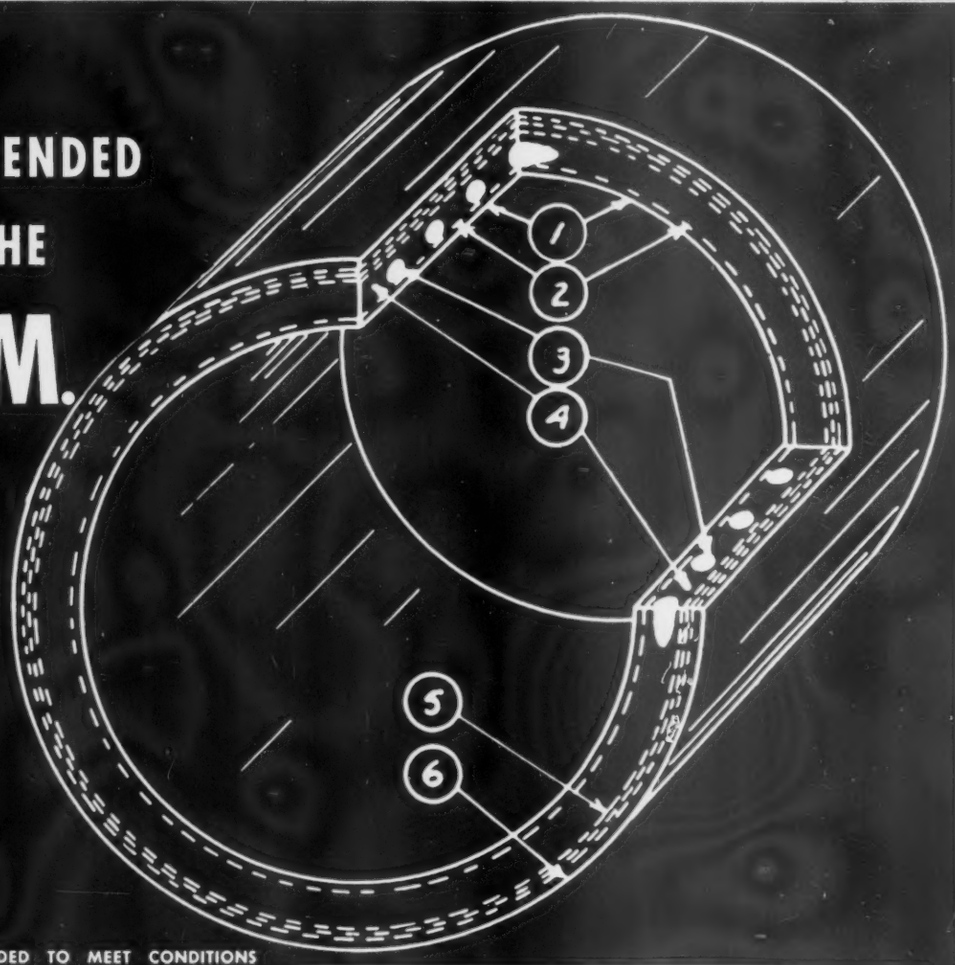

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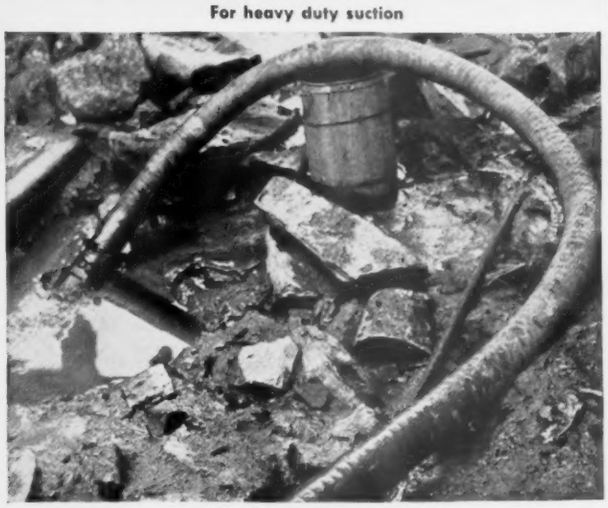

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—many "not there" calls do your men make?
—much do you know about new developments?

The pit and quarry industries are more active now than they have been in years. In fact, it's one of the most active fields in industry. It's natural. For before the roads, dams, bridges, buildings, etc., can be built under the public works program the raw material has to be furnished.

Get your share of it. Don't miss fire with poor prospect lists. Don't lose sales because you had "never heard of that fellow before."

These lists are the most complete ever published. They contain hundreds of new names. They have been completely revised—all listings have been brought up to the minute.

Regardless of whether your territory covers only one state or the whole country the investment in a copy of Pit and Quarry Handbook is something that will pay big dividends—in sales.

To Delay Is to Lose Sales—The Field Is Active—It Is Buying

PIT AND QUARRY, 538 S. Clark St., Chicago, Ill.

☐ Send ..... copies of the 1936 Pit and Quarry Handbook and Directory ($10.00 per copy).

☐ Send ..... copies of the separately bound Pit and Quarry Directory ($10.00 per copy).

☐ Remittance Enclosed ☐ Will Remit Promptly on Receipt of Invoice.

My Name ..... Title .....

Firm ..... Address 5-36

Pit and Quarry gained 59.3%

ADVERTISING VOLUME FOR MARCH ISSUES OF INDUSTRIAL, TRADE AND CLASS PAPERS

Unless otherwise noted, all publications are monthlies

	Pages 1936	1935
Industrial Group		
American Architect	26	13
American Builder & Building Age	75	50
American Machinist (bi-w)	185	131
Architectural Forum	77	68
Architectural Record	46	49
Automotive Industries (w)	74	67
Bakers' Helper (bi-w)	96	92
Brewers Journal	70	67
Brick & Clay Record	17	14
Bus Transportation	65	61
Ceramic Industry	26	23
Chemical & Metallurgical Engineering	140	120
Coal Age	57	50
Confectioners Journal	32	32
Construction Methods	57	49
Cotton	93	90
Electric Light & Power	41	31
Electrical South	38	28
Electrical West	31	22
Electrical World (bi-w)	127	*302
Engineering & Mining Journal	52	48
Engineering News-Record (w)	175	168
Factory Management & Maintenance	117	110
Food Industries	68	58
Heating, Piping & Air Conditioning	58	48
Heating & Ventilating Magazine	35	25
Industrial Power	60	42
The Iron Age (w)	§325	266
Machine Design	50	31
Machinery	147	110
Manufacturers Record	58	54
Manufacturing Confectioner	29	24
Marine Engineering & Shipping Age	44	33
Mass Transportation	9	*18
Metals & Alloys	51	35
Mill & Factory	109	81
Mill Supplies	93	68
Modern Machine Shop	134	92
National Petroleum News (w)	106	137
National Provisioner (w)	118	†123
Oil & Gas Journal (w)	204	165
The Paper Industry	*59	46
Paper Trade Journal (w)	§91	91
Pencil Points	34	27
Pit & Quarry	51	32
Power	142	124
Power Plant Engineering	65	56
Printing	38	39
Railway Age (w)	151	†174
Railway Purchases & Stores	55	41
Roads & Streets	45	44
Southern Power Journal	28	31
Steel (w)	†213	133
Telephone Engineer	24	24
Telephony (w)	67	†82
Textile World	129	*135
Waterworks & Sewerage	22	22
Water Works Engineering (bi-w)	51	48
Welding Engineer	28	23
Western Construction News	68	58
Western Gas	33	29
The Wood Worker	31	26
Totals	4,840	4,380
Trade Group		
American Artisan	42	33
American Druggist	86	85
American Exporter	179	184
Automobile Topics (w)	49	48
Automobile Trade Journal	49	65
Motor Age	‡52	...
Motor World Wholesale	‡43	..
Automotive Daily News (semi-w)	30	32
Boot & Shoe Recorder (w)	186	191
Building Supply News	33	19
Commercial Car Journal	70	58
Domestic Engineering	77	70
Farm Implement News (bi-w)	56	59
Hardware Age (bi-w)	155	148
Jewelers' Circular — The Keystone	78	71
Mida's Criterion	42	59
Motor	94	110
National Grocers Bulletin	32	31
Plumbing & Heating Trade Journal	64	52
Southern Automotive Journal	54	55
Southern Hardware	61	50
Sporting Goods Journal	33	32
Totals	1,470	1,452
Class Group		
Advertising Age (w)	143	x114
American Funeral Director	53	45
American Restaurant	52	44
Dental Survey	92	82
Hospital Management	17	17
Hotel Management	65	51
National Underwriter (w)	36	38
Oral Hygiene	102	109
Traffic World (w)	61	†87
Totals	621	586

†Five Issues.
*Special Issue.
§Last issue estimated.
‡Not included in totals.
xIncludes *Class & Industrial Marketing Section.*

Advertising Continues To Gain Substantially In Business Papers

● THE increasing use of advertising space in industrial, trade and class papers continues to be reflected in reports of business carried in March issues. Sixty-two papers in the industrial group carried 460 pages additional business over issues a year ago, a gain of 9.52 per cent. The increase for the first three months of the year was 21.4 per cent, represented by 15,108 pages for the first quarter of 1936 against 12,438 pages for the 1935 period, a jump of 2,670 pages.

The trade group represented by twenty papers came through March with a gain of eighteen pages over the 1935 month, or 1.2 per cent. An increase of an even hundred pages for the first three months of the year gave the group a 2.36 per cent gain. Total pages carried amounted to 4,329 compared with 4,229 pages in the 1935 quarter. This gain is shown despite the heavy volume of automobile show business carried in papers of that field in 1935 when shows were held in January.

Nine papers representing the class group are making the best showing that division has registered for well over a year. March issues carried 5.97 per cent more business than those of last year, a gain of thirty-five pages for those reporting. The improvement for the first quarter of 1936 amounted to 125 pages, or 7.82 per cent. Pages carried in the current period aggregated 1,722 against 1,597 pages in the first three months of 1935.

for P&Q it was 39.1

Broadens Field

Effective with the April issue *Building Modernization* will be known as *Building and Modernization* and will cover new construction as well as modernization applying to single residences, apartment houses and store buildings.

Increases Rates

Fortune has issued new advertising rates effective June 15, necessitated by growth of circulation to 130,000, a thirty per cent increase over present guarantee. Contracts will be accepted at current rates until that date to apply through the issue of March, 1937.

Walsh to Herman-Nelson

Edward R. Walsh, Jr., has resigned as retail sales manager of Gilbert & Barker Mfg. Company and joined the Herman-Nelson Corporation, Moline, Ill., as general sales manager of the air conditioning and automatic heating division.

Marine Directory Out

"The Marine News Annual Directory" for 1936, a 560-page book, has been issued. The volume lists the names and addresses and personnel of practically all steamship companies, boat builders, repair yards and other divisions of the shipping industry.

John Rolfe Changes

John Rolfe has left the publicity department of Barber-Greene Company, Aurora, Ill., to become sales promotion manager of the All-Steel-Equip company of that city.

Degnan Joins Hill

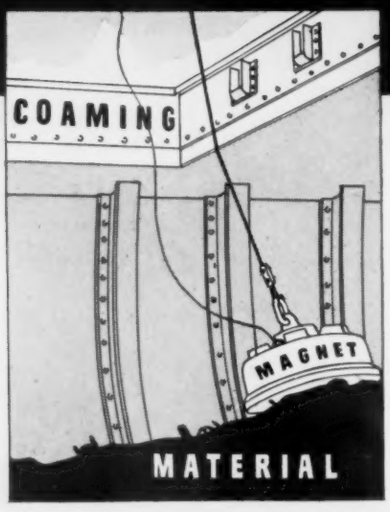
James M Degnan, formerly with Worthington Pump & Machinery Corporation, multi-V-drive and automotive divisions, has been appointed general sales manager of the Hill Diesel Engine Company, Lansing, Mich

Special Issue Postponed

The Chrysler Corporation number of *American Machinist*, announced for May 6 will be published on May 20

LAY·SET *Preformed*

. . . CONSISTENTLY GIVES MUCH LONGER SERVICE IN SPITE OF EXTREME WORKING CONDITIONS



AT one large Michigan plant two Gantry cranes equipped with magnets are used to unload boats of scrap iron. This is a difficult operation because it is frequently necessary to swing the magnet so that it will pick up scrap located underneath the coamings. This results in tough abrasion on the rope when it scrapes along the coaming of the hatch. Sometimes the friction is heavy enough to strike sparks.

This grinding used to break crown wires fast, and when broken it would drive them back into the rope. This resulted in early destruction and difficult handling. The *average* service was six boats per rope.

Then they tried LAY-SET Preformed and found that it lasted much longer and is easier to handle because broken crown wires lie flat and in place. *Consistently,* LAY-SET Preformed ropes are unloading an average of 14 boats.

Specify LAY-SET Preformed for your job. The tougher the job the more you need LAY-SET.

HAZARD WIRE ROPE COMPANY, Inc.
Wilkes-Barre, Pennsylvania
An Associate Company of the American Chain Company, Inc.
IN BUSINESS FOR YOUR SAFETY

District Offices: New York, Chicago, Philadelphia, Pittsburgh, Ft. Worth, Denver, San Francisco, Los Angeles, Birmingham, Tacoma

LAY·SET *Preformed* Wire Rope

ALL HAZARD WIRE ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE GREEN STRAND

THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co., Trenton New Jersey
TRADE MARK
JAR
REG. U.S. PAT. OFF.
Roebling...
The pacemaker in wire rope development

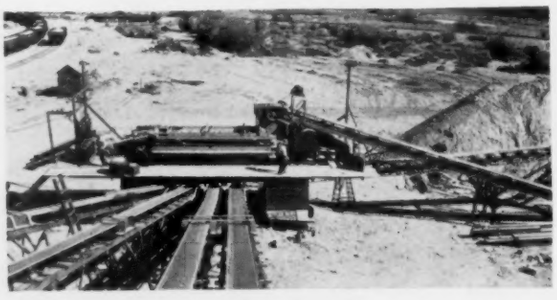
SYMONS SCREENS

COULEE DAM

On the World's greatest material handling and aggregate producing operation, Symons Screens are delivering hundreds of tons of accurately graded material per hour.

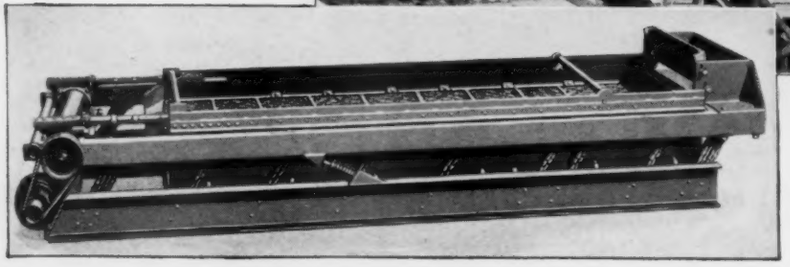
COLORADO RIVER AQUEDUCT

View of the Hawley Plant No. 1 where a 48" by 16' Symons Screen is separating 200 tons per hour into four graded sizes.



T. V. A.

Typical screening plant at the Tennessee Valley Authority project, where two 4x10 foot double-deck Symons Screens are installed for preparing aggregate.



on the World's BIG JOBS

are setting new precedents in production of uniformly sized materials, and meeting easily the rigid requirements of government specified grades of aggregates. Although on the market only a comparatively short time, Symons Screens have so definitely exceeded the performance of contemporary equipment, that they are winning a wide demand in every branch of the industry. In addition to their use in preparing concrete aggregates, Symons Screens are being employed in asphalt paving plants. For example, every hot plant sold for use in California during the past two years is equipped with Symons Screens.

THE NEW SYMONS VIBRATING SCREEN

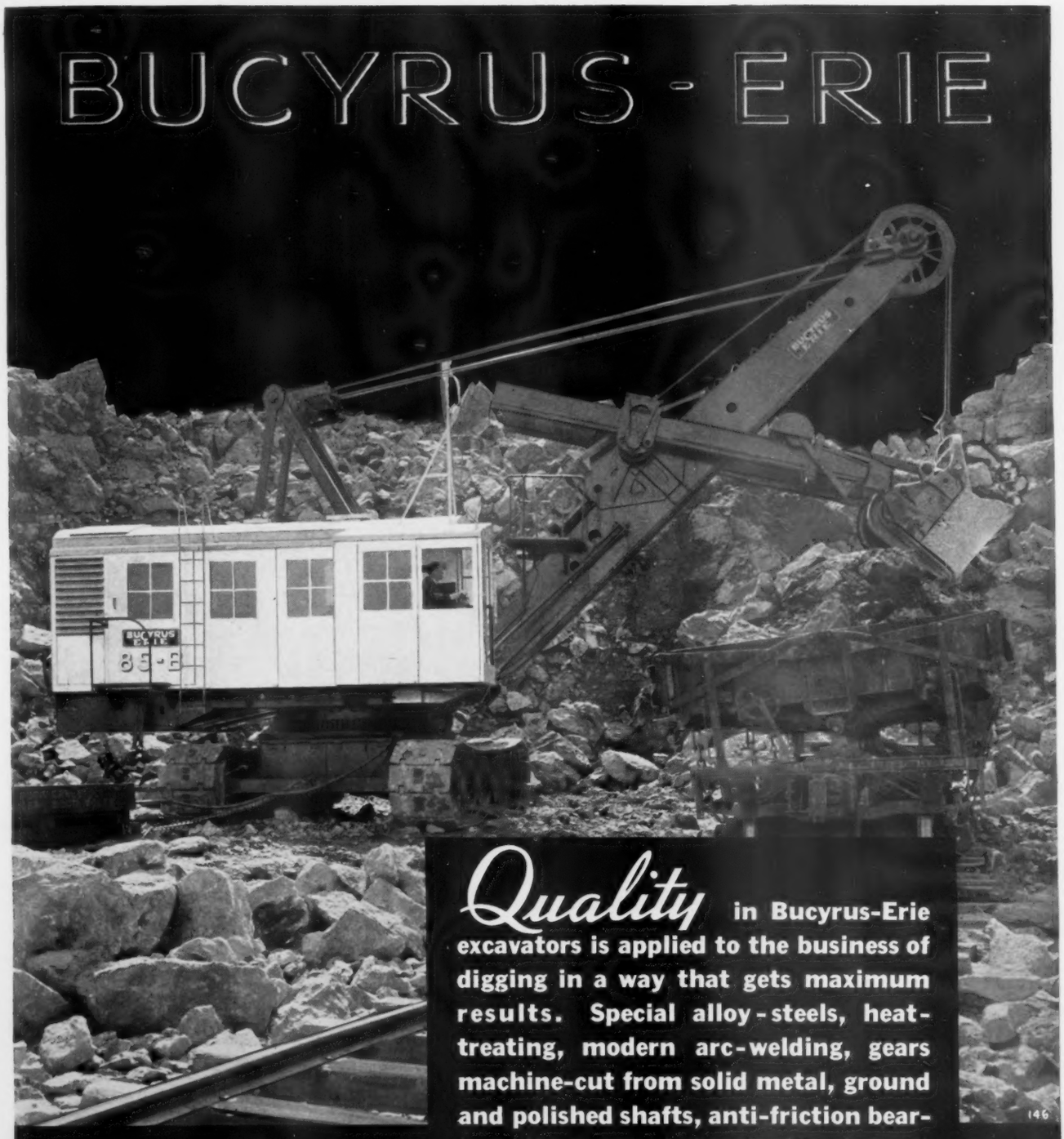
Sets level—Saves headroom—Greater capacity—Closer sizing—Automatic feed—Dust-tight bearings—Enclosed type for dusty operations.

Manufacturers and Sales Agents

SYMONS BROS. DEVELOPMENT CO.
1462 North Stanley Avenue, Hollywood, California
and
NORDBERG MANUFACTURING CO., Milwaukee, Wis.

WRITE FOR BULLETIN

BUCYRUS-ERIE



● Illustrated: 85-B loading rock from cement quarry in New York State.

Quality in Bucyrus-Erie excavators is applied to the business of digging in a way that gets maximum results. Special alloy-steels, heat-treating, modern arc-welding, gears machine-cut from solid metal, ground and polished shafts, anti-friction bearings, the finest of electrical equipment and control, all contribute to the famous Bucyrus-Erie dependability that means steady production, the modern Bucyrus-Erie speed that means profits for owners. Write for information on the size that fits your requirements!

BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN, U. S. A.

If PREFORMED WIRE ROPE SERVES YOU BEST

Try "Form-Set"

Williamsport's method of preforming

"Form-Set" has the utmost in every quality—the toughest, most durable fatigue resisting Wire—the most minute accuracy in the sizing and fitting of the Wires—the most careful and exacting fabrication—plus precision *Pre*forming.

Try "Form-Set" on a strictly comparative basis. It has the "stuff" and its performance will prove our every claim.

Send for our Catalog just off the press.

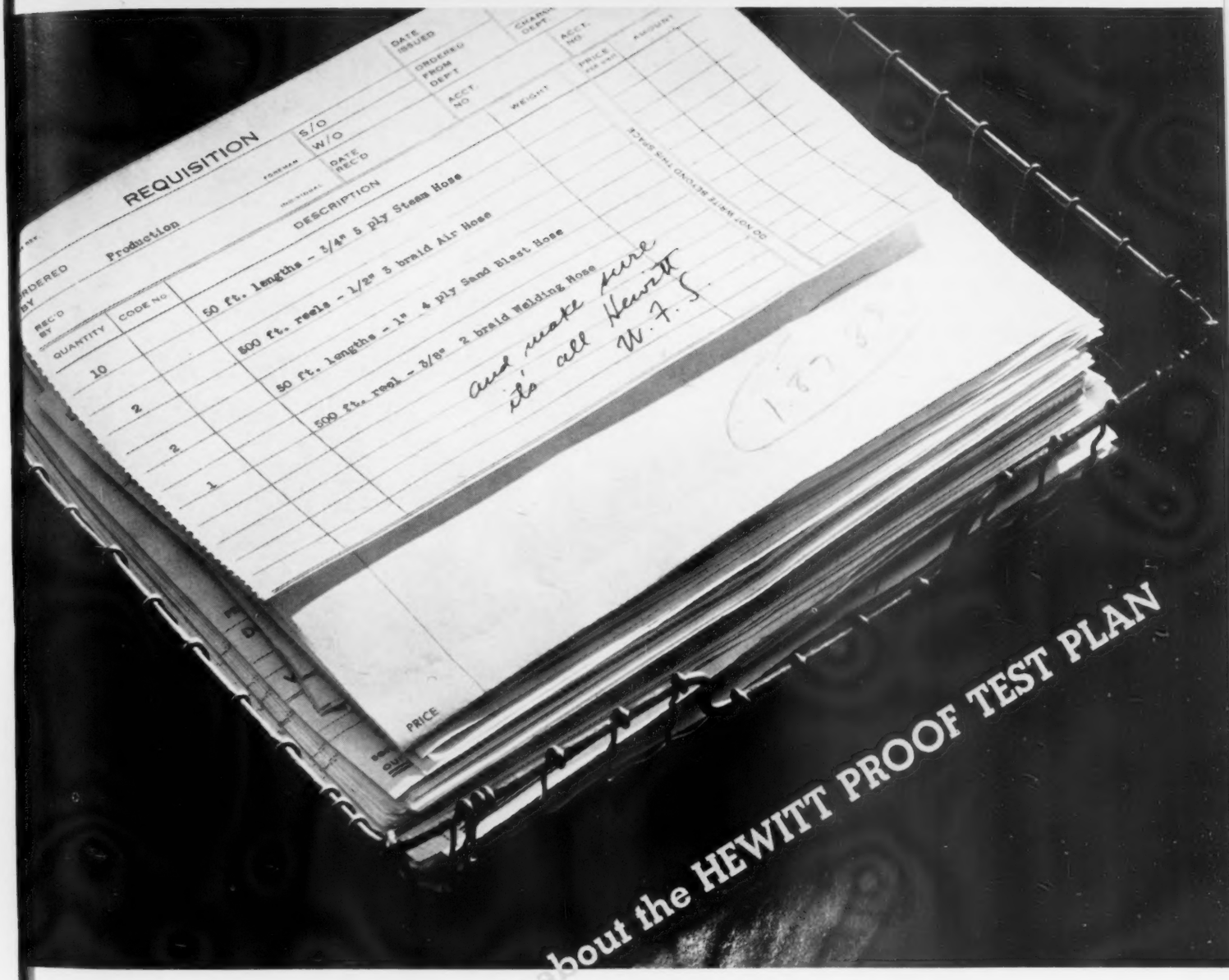
WILLIAMSPORT WIRE ROPE CO.

Williamsport, Pa. 122 So. Michigan Ave., Chicago, Ill.

Other Offices in All Principal Cities

PRINT IN

RECOGNITION


REQUISITION
Production
DESCRIPTION
50 ft. lengths - 3/4" 5 ply Steam Hose
500 ft. reels - 1/2" 3 braid Air Hose
50 ft. lengths - 1" 4 ply Sand Blast Hose
500 ft. reel - 3/8" 2 braid Welding Hose
and make sure it's all Hewitt
W. F. S.
PRICE

...bout the HEWITT PROOF TEST PLAN

Recognized leadership is not born of advertising claims. In the industrial world leadership is the product of superior performance, proved in actual practice. That is the only reason HEWITT hose is the accepted leader throughout industry ... the one reason why men concerned with production and operating costs, who compare costs, insist on HEWITT.

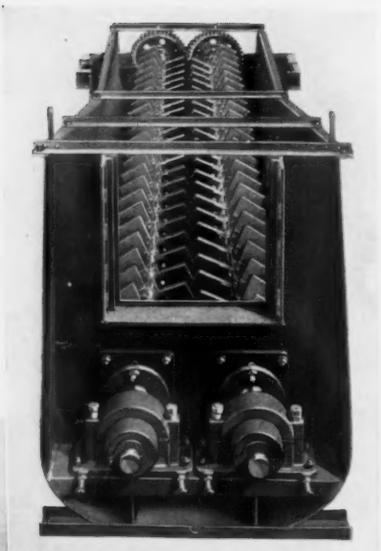
Dedicated to the production of industrial rubber goods, EXCLUSIVELY, HEWITT is constantly and steadily linked with leadership, a recognition earned by the longer service of HEWITT products at lower cost. HEWITT distributors are nearby. They are listed in the classified telephone directories of industrial centers under "Rubber Goods" or "Belting".

HEWITT

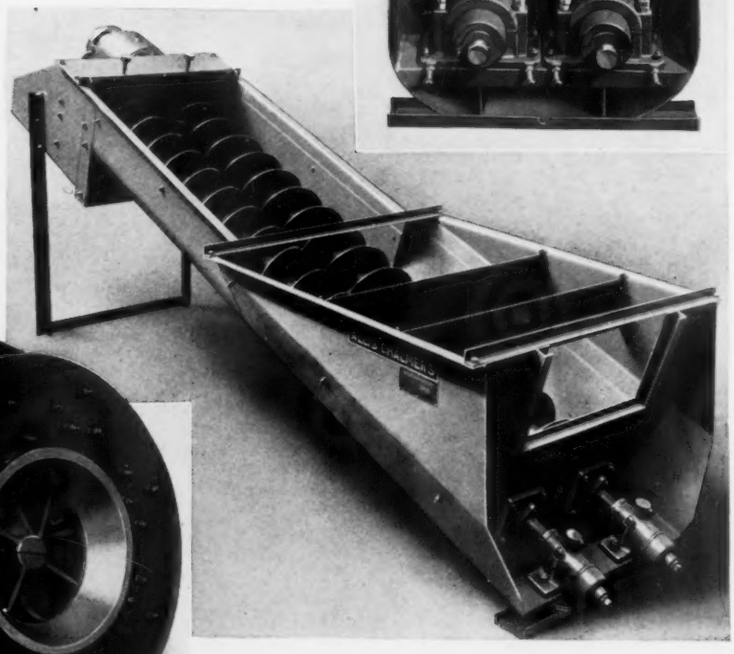
RUBBER CORPORATION, BUFFALO, N. Y.

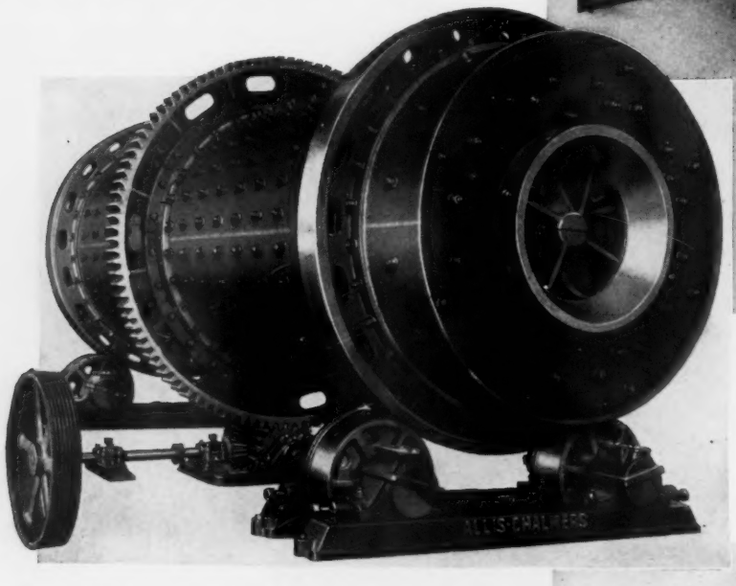
RINT IN BINDING

Refer Your Washing Problems to Allis-Chalmers

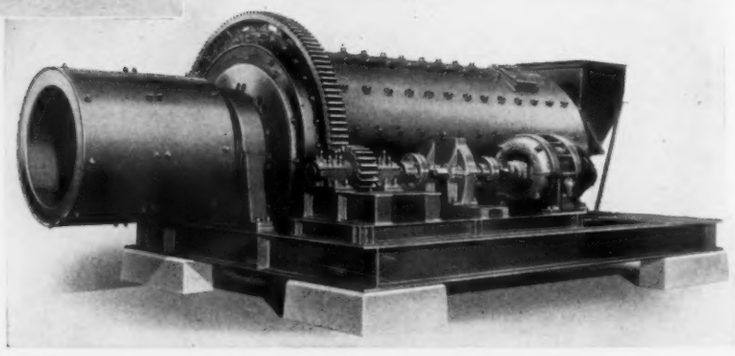


THE selection of the proper equipment to produce clean aggregates requires careful consideration, whether it is for a plant which has been operating dry or for a new washing plant. The experience of the Allis-Chalmers Manufacturing Company in the manufacture of equipment required for plants producing commercial aggregates dates from the industry's infancy, and this experience is reflected in the design and application of its products.





Double Screw Log Washer
Double Screw Sand Washer
Revolving Stone Scrubber
Revolving Blade Mill



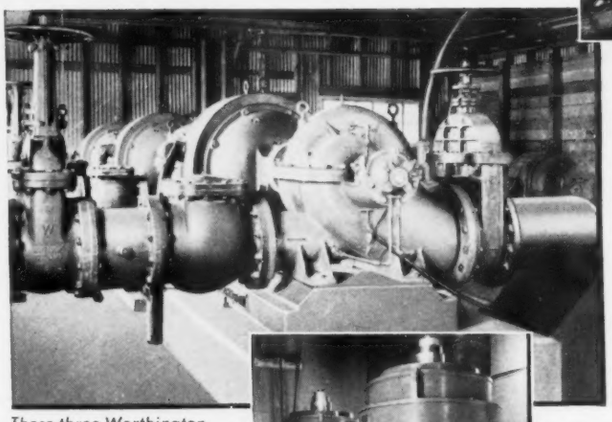
Allis-Chalmers builds a complete line of scrubbers, log washers, sand washers, scrubber screens, and vibrating screens, especially designed for washing aggregates. The blade mill, shown at the right, is a new development. It is especially adapted to materials carrying large percentages of clay and may handle pieces of larger size than other types will take. Some materials require one type of machine and some another. Sometimes a combination of machines is necessary for removing all foreign material. We suggest you call on our nearest district office for further information or for recommendations on your particular problem.

ALLIS • CHALMERS

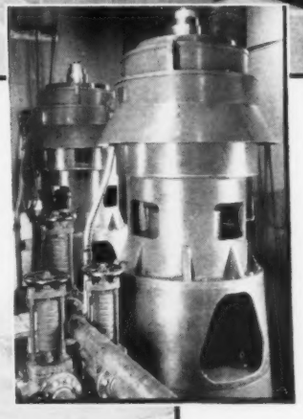
MILWAUKEE WISCONSIN

WORTHINGTON PUMPS SERVE BIG AGGREGATE PLANT at Grand Coulee

General view of the M-W-A-K Aggregate Plant, for which Worthington Pumps furnish 25,500 g.p.m.



These three Worthington Centrifugal Pumps recirculate 18,000 g.p.m. against a 170′ head



Two of three Worthington Deep Well Turbine Pumps ... each pumping 2500 g.p.m. against a total head of 670′

The pump house on the Columbia river

WATER... 25,500 gallons every minute, is required to make M-W-A-K Company's mammoth Aggregate Plant work. A veritable deluge constantly pouring over the screen areas, accelerating the screening process and washing out the silt and excess fines... this water must be brought from the Columbia River half a mile away and 670 feet below. Any interruption to the supply would immediately reduce operating efficiency and might cause a complete shutdown of the entire plant.

Here, as elsewhere throughout this project, the contractors have selected Worthington to meet their pumping requirements. Three Worthington Deep Well Turbines, each of 2500 g.p.m. capacity and powered with a 500 hp. electric motor, lift water 70 feet from the river to the pump house on the trestle, forcing it another 600 feet vertically to a 100,000 gallon fresh water tank near the screen house. Clarified water from the screen house is recirculated by three Worthington Centrifugal Pumps, each powered by a 300 hp. electric motor and rated at 6000 g.p.m. against a 170-foot head.

The confidence placed in Worthington equipment by M-W-A-K Company is a tribute of which this organization is proud. You too can depend upon Worthington service for your jobs, large or small... and Worthington distributors can help you with your equipment problems.

... also at Grand Coulee, Worthington High-pressure Pumps force grout into every crack and fissure in the foundation bedrock. Worthington Vertical Turbine Pumps dewater the cofferdams. Numerous other pumps perform a variety of services.

Worthington Compressors actuate concrete equipment at the mixing plants. A Worthington Rockmaster speeded the drilling in bedrock within the west cofferdam. Worthington Portable Compressors, Drifter Drills and other Air Equipment, as well as 7000 hp. of Worthington V-Belt Drives contribute to the splendid progress of the entire Grand Coulee Project.

WORTHINGTON PUMP AND MACHINERY CORPORATION

General Offices: **HARRISON, NEW JERSEY** - *Branch Offices and Representatives in Principal Cities throughout the World*

WORTHINGTON

ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT EL PASO HOUSTON KANSAS CITY LOS ANGELES NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH ST. LOUIS ST. PAUL SAN FRANCISCO SEATTLE TULSA WASHINGTON

A-36167

We Control our product

TO HELP YOU CONTROL YOURS

AT our mines the control on Lorain Grinding Balls starts. It follows right on through to the time they are delivered — ready to grind *your* materials and help you, too, make a better finished product.

Uniformity, therefore, is assured in Lorain Grinding Balls. You get correct structural characteristics and proper physical properties in the metal because of scientific metallurgical control. You get proper finishing and heat treatment because of control at those stages.

Order Lorain Balls for cement or other grinding in these diameters— ½", ⅝", ¾", ⅞", 1", 1¼", 1½", 2", 2½", 3", 3½", 4", 4½" and 5".

OTHER LORAIN PRODUCTS

Mill Liners and Screens of Manganese, Chrome Nickel and plain Carbon Steel or Hard Iron; Hammers for Swing Hammer Mills; Industrial Cars and Trackwork.

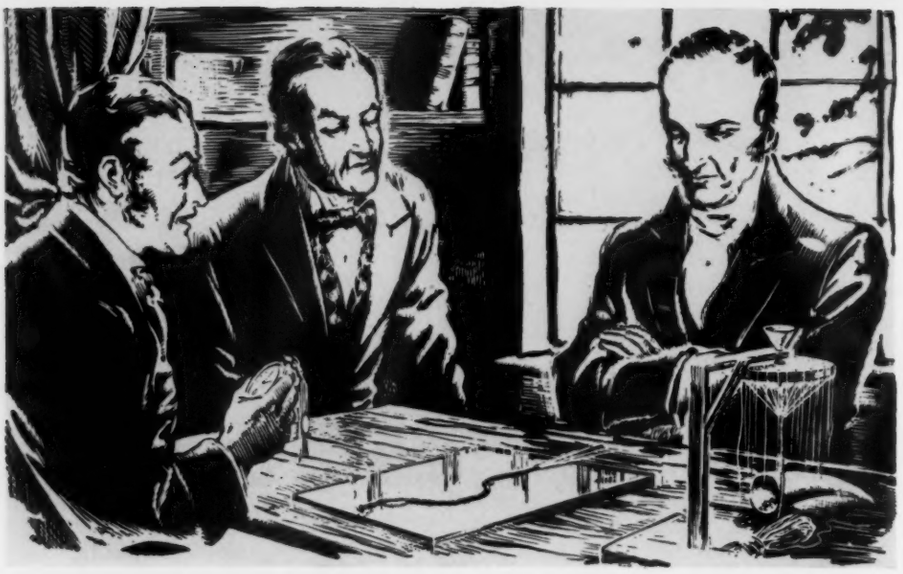
CARNEGIE-ILLINOIS STEEL CORPORATION
Lorain Division · Johnstown, Pa.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*. United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Beginning
a New
CENTURY

He TIMED *his* FUSE *for* 100 YEARS



THROUGHOUT the ages there have been those who refused to accept the status of their times —who placed the welfare of mankind above personal gain, and determined that the fruits of labor should not be death or disability.

Such was William Bickford, inventor of Safety Fuse. He was a leather merchant—and philanthropist —in Tuckingmill, Cornwall, England. His labors among the Cornish miners brought to him a growing realization of the tragedy of their lives; instilled

1836: Straws, and a train of powder

in him a determination to *find a way* to lessen the dangers of blasting.

In those days, blasting was done with gunpowder ignited by fuses made of wheat straws or goose quills, nested together and filled with fine powder. Such makeshifts were obviously unreliable, and too often resulted in premature explosions. Mr. Bickford experimented with these, and also with tubes of paper and leather without satisfactory results.

One day he visited a rope maker in Tuckingmill, and walked with him along his rope walk. As he watched the man twist the rope, it occurred to Mr. Bickford that if a funnel filled with gunpowder could be so fixed as to pour a stream of powder into the center of the twisting strands, and if these strands could be securely fastened and waterproofed, it would provide a slow-burning fuse. After many experiments he succeeded, and in 1831 obtained a Royal Patent for "Miners' Safety Fuse." That same year the firm of Bickford, Smith and Davey was formed and began the manufacture of Miners' Safety Fuse at Tuckingmill.

IN 1836 this new industry in an old country stretched forth its arm to assist an old industry in a new country. The Copper Hill Mine, located within the original boundaries of Simsbury, Connecticut, is recognized as the first copper mine in America. During the Revolution and for several years thereafter the mine was used as a prison, and became known as "Old Newgate." About the year 1830 a group of capitalists took over the property and organized the

"A Way must be found . . ."

Phoenix Mining Company, engaging Richard Bacon of Simsbury as superintendent.

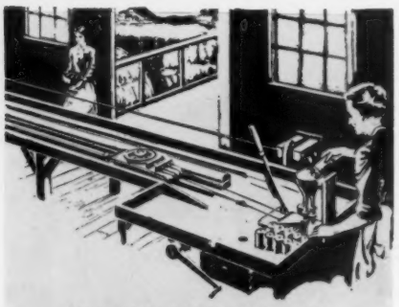
Here, as elsewhere in the mining industries, blasting was an extremely hazardous occupation. Mr. Bacon, learning of Bickford's Safety Fuse, opened negotiations with the English firm in 1836 which led to the establishment at East Weatogue, Connecticut, of an American company under the firm name of Bacon, Bickford, Eales & Company; and manufacture was started with machinery sent over from England. Following a fire, a newer plant was established on a small water-power site nearby, and manufacture was continued.

The early fuse machinery consisted of a spinning bench with traveling "jennies" which drew and twisted the yarn for a distance of about 60 feet. Powder was fed to the center of the twisting strands; and the 60 ft. lengths were then "countered" and coated with waterproofing compounds.

One is impressed with the hardihood of these pioneers. Viewed in the light of present-day continuous methods, with precision machinery, automatic controls and fire prevention facilities, the early rope walk system seems crude. Yet it produced a slow-burning fuse which quickly supplanted the dangerous straw and goose quills, and turned a fateful operation into one of comparative safety.

ONE August day in the year 1839, a family of five left Hartford, Connecticut, in a heavy wagon, surrounded by their worldly possessions. Their destination was East Weatogue, more than ten miles away over the hills—the end of a 3,000 mile journey from England.

As they came to the top of the high hill overlooking the tiny village, their



Along the Rope Walk came Safety Fuse

journey was cut short by the breaking down of the wagon. The weary travelers alighted and took their way down to the village. And thus it was that Joseph Toy, his wife and three children completed a tedious six-weeks' journey from England.

Mr. Toy was a young bookkeeper sent to America by the English firm to represent their interests in Bacon, Bickford, Eales & Company. He never returned to England, but became an American citizen, and established an industry with which his family has been actively identified for four generations.

A Long Journey Ended—Another Begun

TWELVE years passed — difficult years, with progress gained against opposition within and without. Joseph Toy had become a junior partner in the concern, having purchased the interest of Joseph Eales who had retired; but his position was not an easy one, and it is evident that matters reached a crisis in March 1851.

"P. S. The mill was entirely destroyed by fire . . . "

A terse postscript to a letter he had previously written to the partners in England reads:

"P.S. The mill was entirely destroyed by fire this morning. Everything is consumed but the wheel—all our books and papers are gone—what a misfortune!"

The fire marked the turning point, however, for a new dawn came with the establishment, in May, 1851, of the firm of Toy, Bickford and Company. A factory was built on the present site at Hop Brook in Simsbury, and the first fuse was sent to Boston on June 14th. By the middle of July, Mr. Toy reported to his English partners that things were—

"progressing well — new concern sold fuse to end of June about $3,500. By dint of management we have the names of nearly all our old customers on our new books. My handwriting has done more than ten traveling agents could do."

The New Secret Process

YEARS moved by. A growing America was demanding greater industrial production. New problems faced the Safety Fuse industry, calling for new methods of manufacture. The days of the old "spinning jenny" were fast drawing to a close.

Joseph Toy recognized these needs, yet hesitated to adopt new and speedier methods. Even in those days Bickford Safety Fuse was noted for its uniform dependability. Its manufacture, like its operation, was *slow but sure*. For this reason many miles of fuse were made and tested in secret before Mr. Toy was satisfied that the new "continuous process" machines would be able to meet his exacting standards.

From then on the business grew rapidly. The company was able to improve quality, increase output, lower prices. In 1863 Mr. Toy's son-in-law, Mr. Ralph H. Ensign, entered the business, followed in 1871 by another son-in-law, Mr. Lemuel S. Ellsworth. In 1887 Mr. Toy died, and the firm name was changed to Ensign, Bickford & Company. In 1907 a consolidation with the Climax Fuse Company, of Avon, Connecticut, took place, the new firm being incorporated as The Ensign-Bickford Company.

A quotation from a letter written by the English partners to Mr. Toy gives a clue to the policies that have shaped the destinies of the Fuse Industry in America:

"We are assured of an important fact—that the superior quality of the fuse is your sheet anchor."

Four generations of fuse manufacture by four generations of fuse manufacturers have established standards that are *checked and double checked*—

Check—and Double Check

nothing is left to chance. For Safety Fuse must ever be dependable.

As we stand on the threshold of a new century we are grateful: for the past, which one hundred years ago gave us a firm foundation; for the present, which brings us tangible evidence of the confidence of our customers; and for the future, which will bring new opportunity.

Upon request we shall send you, free, a copy of our new Centennial Booklet, giving a more detailed history of Safety Fuse. The booklet will be available about the middle of May.

Sixty-seven buildings with a total of forty-two acres at Simsbury and Avon, Conn., devoted to the manufacture of Ensign-Bickford Safety Fuse and Cordeau-Bickford Detonating Fuse. Safety lies in skill—skill in manufacture, skill in use. We do our part well.

THE ENSIGN-BICKFORD COMPANY

Simsbury, Connecticut

ENSIGN-BICKFORD SAFETY FUSE CORDEAU-BICKFORD DETONATING FUSE

Blasting in mines and quarries in the early days before the invention of safety fuse was a precarious business. The shot-firer had to be extremely agile to escape.

A Short History of Progress in Explosives and Blasting

By HARRY F. UTLEY

GENERAL credit for the invention of gunpowder is usually given Friar Roger Bacon who concocted an explosive mixture composed of saltpeter, charcoal and sulphur in England about 1242 A.D. Its use in crude fire-arms is traced back to the beginning of the fourteenth century, but it was not until a century later that its first consideration in blasting is recorded. In 1403 an attempt was made at blasting fortifications during the siege of Pisa but this was unsuccessful.

Nearly four hundred years elapsed following Bacon's discovery before gunpowder was employed in mining. The first instance of its use in breaking down ore came in 1627 when a Tyrolean, Kaspar Weindl, used it with success in the royal mines of Schemnitz in Ober-Biberstollen, Hungary. The practice spread slowly, however, partly on account of fear of collapse of the roof, partly on account of the lack of suitable drilling implements, and largely on account of the high cost of the powder which ran to the equivalent of $2.50 per pound. But in 1632 it was used in Clausthal (Germany), in 1645 in the mines at Freiberg, and in 1648 at Falun (Sweden) for bringing down ore.

The first use of gunpowder in engineering is believed to have been in 1696, when the Albula Road in Switzerland was widened by blasting.

When the Pilgrims landed at Plymouth Rock in 1620 they brought fire-arms and a supply of gunpowder from England. Obscure attempts at making powder, using saltpeter crystallized from liquids extracted from dung-heaps, are on record among these early settlers but the first powder-mill as such was built on the river at Milton, Mass., in 1675. It operated for nearly 80 years and in 1744 set a precedent for the many explosive plants which were to follow by blowing up and destroying the buildings, and scattering the remains of its luckless workmen upon a near-by hillside and scaring the industrious Colonial dames who resided in the vicinity nearly out of their wits.

Powder mills sprang up rapidly in the colonies immediately preceding and during the Revolutionary War but not until the beginning of the nineteenth century did the black-powder industry change from one of a "home-spun," or local, character to one of national importance and magnitude. The change was so great that even before the Civil War, exports of powder were not infrequent. Prior to the Revolution practically all the powder was used in fire-arms for military and hunting purposes; later the commercial use of powder in mining and engineering works gradually outstripped the former. The large number of small mills was due chiefly to the difficulties of transportation. Since it was impractical to ship the product any great distance, the mills were located where the demand existed and where there was a good supply of water power and of wood for making charcoal. But as roads, canals and, later, railroads were built and improved the industry tended to center where both manufacturing conditions and transportation facilities were most favorable.

From France at the turn of the century came one who was to play an important part in the growth and development of the American explosives industry and of America itself. On New Year's Day, 1800, Eleuthére Irenée du Pont landed at Newport, R. I., after a perilous crossing of the Atlantic on a sailing ship that had been 95 days at sea. Two years later he built the first du Pont black-powder mill on the banks of the Brandywine at Wilmington, Del. The elder du Pont's powder soon set a standard which others of the early makers sought to follow. Trained under Lavoisier, the famous French chemist and head of the French Service des Poudres et Saltpetres, du Pont gave careful attention to the purification of the ingredients and the separate steps of manufacture. This naturally gave a better product than the rule-of-thumb methods pursued in many other mills. While on a pedestrian tour of the Pennsylvania wilds in 1804, Wilson, the American ornithologist, met a huntsman who so admired this powder that he mentions it in his poem, *The Forester:*

From foaming Brandywine's rough shores it came,
To sportsmen dear its merit and its name;
Du Pont's best Eagle, matchless for its power,
Strong, swift and fatal as the bird it bore.

The period from the beginning of the nineteenth century to the Civil War saw the beginning of all the large powder companies that made powder history in the years following that great conflict. The history of the last sixty years or so is perhaps not as picturesque as that of the early days. It is not a story of the origin of small companies, owned and operated by one man or one family under the primitive conditions of the frontier, but a romance of big business, of a fierce competitive struggle and the survival or emergence of a few strong concerns. Prices often fluctuated violently from a fair, profitable level to figures that would barely (and often did not) cover the cost of production. Outstanding in the struggle

were the successful efforts of a few far-sighted men who succeeded in organizing and stabilizing the industry. Their efforts, particularly in educating users to obtain the most results with the least expenditure for explosives, brought about marked savings to consumers.

On the technical side production methods became more standardized, the old stamp and barrel mills disappeared, and many mechanical improvements were introduced to make operations less hazardous, more efficient and less costly. Wheel mills, first introduced in 1820, gradually supplanted the stamp and barrel units but not until the present century did this transition become complete.

From the first record of use in 1627 until more than two hundred years later, black powder was the only explosive used for blasting. Drilling was done by hand and was slow and uncertain. Charged holes were ignited by means of a torch or a red-hot rod. A train of fine powder led to the main charge, or a "pipe-line" of goose quills or rice straws was filled with powder to form a crude fuse to enable the shot-firer to escape, if he moved fast enough. It was in the period just preceding the Civil War that important advances in the blasting art were felt. These included (1) the development of high explosives by Nobel and others, (2) the invention of safety fuse by William Bickford, and (3) the discovery and application of the machine drill.

Nitroglycerine, the basis of the high-explosives industry, was discovered in 1846 by Prof. Ascanio Sobrero, at the University of Turin, who announced his invention a year later before the Royal Academy of Science. It remained more or less of a scientific curiosity, however, until Alfred Nobel began studying its possibilities in 1860. He built a factory in Stockholm in his native Sweden and sent bottles of it to various parts of the world under the trade name of Glonion Oil. In nearly every instance he received news sooner or later that each consignment had caused a disastrous explosion. One of these occurred in the Wells-Fargo express office at San Francisco, part of a lot consigned to Julius Bandmann to whom Nobel afterwards assigned the United States patent for dynamite taken out in 1867.

But Nobel patiently went on experimenting. He had solved the problem of making nitroglycerine commercially but he still had to find a way to prevent it from exploding when an explosion was not wanted, and to explode it when an explosion was desired. Not being a chemist by training, Nobel failed to realize the necessity of thorough purification of the nitroglycerine. Without such purification decomposition sets in and the liquid is sensitive to the slightest jar while it generally explodes sometime or other anyway if kept confined. The pioneer in clearing up the matter, though his work came some years later, was George M. Mowbray, who manufactured the liquid nitroglycerine for boring the Great Hoosac Tunnel at North Adams, Mass. All later manufacturers followed the standard set by Mowbray.

It remained for Nobel, however, to strike the keynote of safety, for he came to the realization that the liquid form of nitroglycerine was in itself a danger. Hence came the invention of dynamite, the greatest step in the advent of high explosives. Nobel achieved this by absorbing nitroglycerine in the porous earth, kieselguhr, the result being a highly-explosive paste with some resilience and capacity for absorbing shocks. Later the filler was modified and by 1867 Nobel had overcome all the difficulties and his dynamite served the world well as a high explosive for nearly sixty years.

Nobel continued his research and development in explosives, patenting blasting gelatine and gelatine dynamites in 1875. In 1887 he gave the world "ballistite," a smokeless powder.

William Bickford, a leather merchant who lived in Cornwall, England, early in the nineteenth century, had long seen and deplored the terrible frequency of accidents in the mines in that vicinity. In attempting to circumvent these evils he worked for years on a method of safely setting off the blasting charges. One day he watched the forming of hemp into rope in a rope-walk in the town of Tuckenmill. The idea flashed across his mind that if a funnel could be fixed to pour a stream of gunpowder into the center of the rope as it was spun and the cord later be coated with some inclosing substance, a safe and satisfactory means of conveying fire to the main charge would result. Thus, in 1830, was the safety-fuse idea born. Bickford obtained a patent on the idea and with his son, John, his son-in-law, George Smith, and a friend, Thomas Davey, organized the firm of Bickford, Smith & Davey to manufacture it. The basic principles laid down in the original English patent remain unchanged in essence today, although the improvements in the quality and in the control of uniform burning have gone much farther than was possible even a decade ago.

In the United States in 1830 the Phoenix Mining Co. began operating the first copper mine in the country at Simsbury, Conn. Its superintendent, Richard Bacon, heard of Bickford's new fuse and in 1836 induced the Englishman to establish an American fuse-making branch. The firm became Bacon, Bickford, Eales & Co. and the mill at Simsbury used machinery imported from England. Three years later, Joseph Toy, arrived at Simsbury from England to serve as bookkeeper for the firm and to represent Mr. Bickford's interests. He later became a partner, purchasing the Eales interest. Then in 1851 came a fire which de-

(Continued on page 28)

. . . from France at the turn of the century came Eleuthère Irenée du Pont who established the first du Pont black-powder mill at Wilmington, Del., in 1802 . . .

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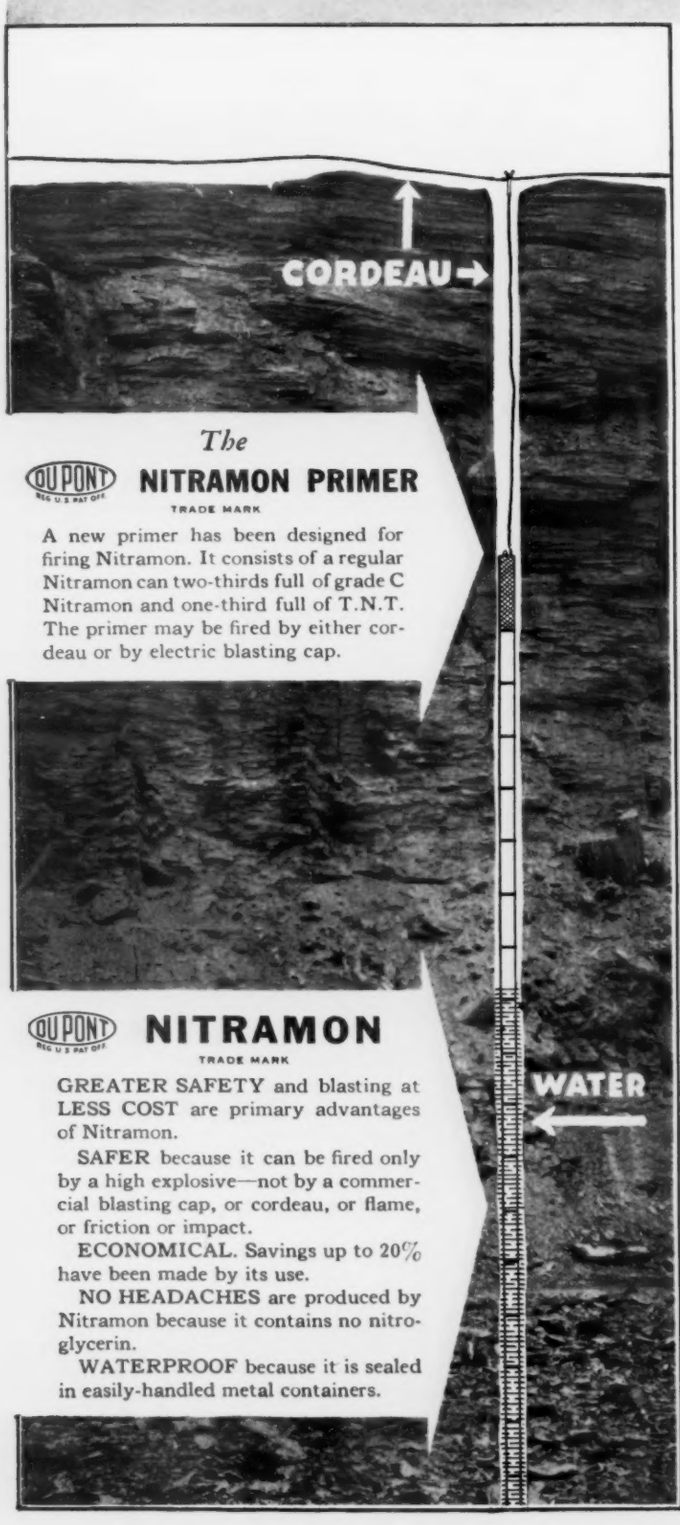


The

DU PONT NITRAMON PRIMER

TRADE MARK

A new primer has been designed for firing Nitramon. It consists of a regular Nitramon can two-thirds full of grade C Nitramon and one-third full of T.N.T. The primer may be fired by either cordeau or by electric blasting cap.

DU PONT NITRAMON

TRADE MARK

GREATER SAFETY and blasting at LESS COST are primary advantages of Nitramon.

SAFER because it can be fired only by a high explosive—not by a commercial blasting cap, or cordeau, or flame, or friction or impact.

ECONOMICAL. Savings up to 20% have been made by its use.

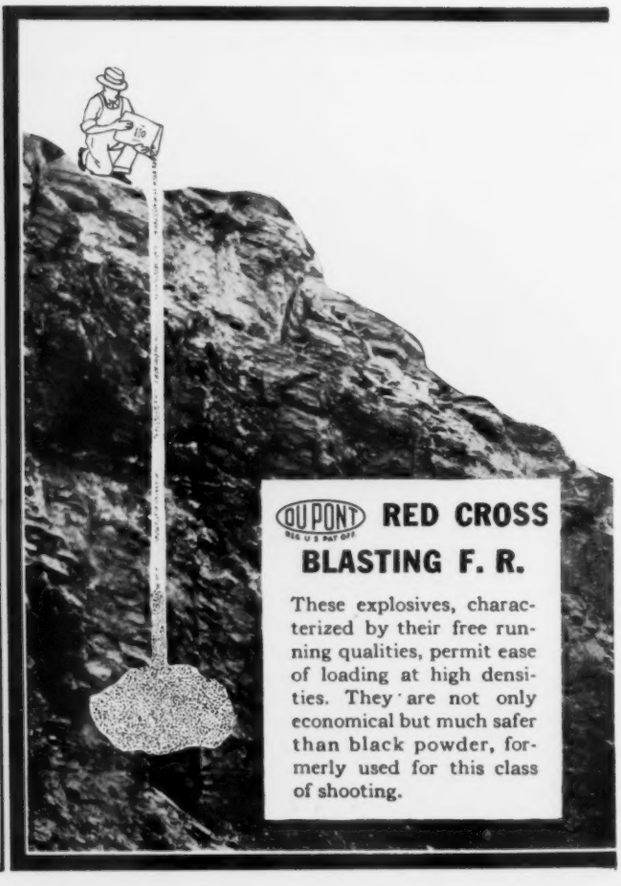
NO HEADACHES are produced by Nitramon because it contains no nitroglycerin.

WATERPROOF because it is sealed in easily-handled metal containers.

SAVE MONEY by using the RIGHT explosive in every part of every shot you make. Be sure that every bore hole is loaded with the right amount of the right strength of the right explosive before every shot is fired. Lower costs result from carefully planned shots.

Du Pont representatives will help you determine the *right* explosive for your job.

Du Pont maintains nation-wide distribution



DU PONT RED CROSS BLASTING F. R.

These explosives, characterized by their free running qualities, permit ease of loading at high densities. They are not only economical but much safer than black powder, formerly used for this class of shooting.

EXPLOSIVE

FOR EVERY QUARRY NEED

of explosives, making it possible for you to get the *right* explosive for the job you have in hand —at the time you want it.

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Explosives Department, Wilmington, Del.

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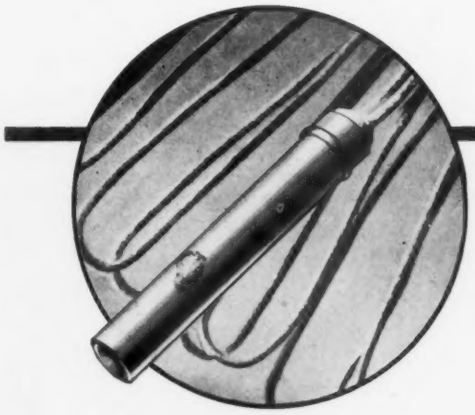
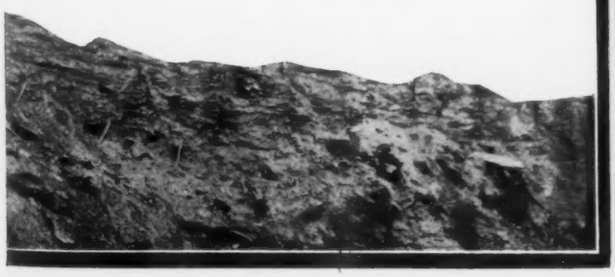


The Famous

DU PONT **ELECTRIC BLASTING CAP**

More than 900,000,000 of these caps have been used in the past 25 years. They are of uniform quality; give complete detonation of charges—that's why they are the world's largest selling blasting cap.



DU PONT **EXTRAS** *and* **RED CROSS EXTRAS**

Most economical for top loads, due to low cost per foot of bore hole.

DU PONT **GELATIN** *and* **GELEX**

Best suited for bottom loads, due to high loading density and water resistance.

(Continued from page 25)

stroyed the mill. The firm was reorganized as Toy, Bickford & Co., a new plant built and the concern continued to prosper as the years rolled by. In 1863 Mr. Toy's son-in-law, Ralph H. Ensign, entered the business and when Mr. Toy died in 1887 the firm name was changed to Ensign-Bickford & Co. A consolidation with the Climax Fuse Co., in 1907, gave the firm its present name of The Ensign-Bickford Co.

In the year 1913 The Ensign-Bickford Co. introduced Cordeau-Bickford detonating fuse in the United States. Cordeau had been invented by Louis L'Heure in Paris. It consists of a lead tube filled with trinitrotoluene. A rate of burning of more than three miles per second makes it practically instantaneous and allows its wide-spread use for the simultaneous firing of many holes. The first blast with the product was detonated Aug. 16, 1913, in the quarry of the Atlas Portland Cement Co. (now Universal Atlas Cement Co.) at Northampton, Pa. Now it is available in several varieties. Plain Cordeau is what the name implies, but the tensile strength and resistance to abrasion may be varied by the addition of outer coverings of textiles or wire, or a combination of both.

About the time the safety fuse was invented, the discovery of mercury fulminate and its application in percussion caps for detonating explosives was announced, although it has never been definitely determined who the original inventor was. Electric exploders had their origin even earlier, although the perfection of electric blasting caps and the electric blasting machine came during the middle of the nineteenth century. Common blasting caps were not produced in this country until about 55 or 60 years ago, since the need for this type of detonator was not apparent until high explosives came into their own.

Since the first dynamite was manufactured in the United States in 1867 at San Francisco, little was done in the way of improving commercial high explosives until recent years. Ammonia dynamites were introduced for blasting purposes in 1892 and the ammonia "permissibles" came into use in 1908. Nitrostarch explosives came into limited use about 20 years ago. Other high explosives were introduced from time to time but few have been retained to any large extent. The following three types of dynamites are still the most widely used: (1) gelatin dynamites, (2) ammonium nitrate dynamites and (3) straight nitroglycerine dynamites. Blasting powder is still used, although its employment becomes less frequent each year. In 1934, according to the U. S. Bureau of Mines, the following quantities of explosives used in quarrying and nonmetallic-mining were produced: High explosives (other than "permissibles"), 34,491,000 lb.; "permissible" explosives (those approved as suitable for use in coal mines), 287,000 lb.; and black blasting powder, 1,850,000 lb.

Early in the present century the du Pont interests had obtained control of much of the explosives industry in the United States. On January 1, 1913, the operating companies were regrouped into three concerns, the E. I. du Pont de Nemours & Co., the Hercules Powder Co. and the Atlas Powder Co., all Delaware corporations. In 1921 the Hercules company purchased the Aetna Explosives Co. Since that time there have been few changes within the industry, the three concerns set up in 1913 controlling the bulk of the business. Independent producers still in existence today, together with the year of their organization, include the following:

Austin Powder Co. (1867); King Powder Co. (1889); Equitable Powder Co. (1892); Trojan Powder Co. (1903); Egyptian Powder Co. (1903); United States Powder Co. (1904); Illinois Powder Mfg. Co. (1907); and Western Powder Co. (1908).

Burton Explosives, Inc., a division of the American Cyanamid & Chemical Co., and Halafax Explosives Co. are more recent names in the industry.

Industrial life today is absolutely dependent upon explosives and blasting—and the making of America would have been impossible without them. Over a billion tons of rock and ore are moved annually by blasting. The nonmetallic minerals of construction are thus made available for use; the fuels and metals of industry, commerce and every-day life are so supplied. The railways, rivers, harbors and canals, great aqueducts and dams, highways and subways have been dependent upon explosives for their development. Farm lands have been blasted clean of stumps and boulders to simplify the raising of foodstuffs.

Practically all this advance has come since the introduction of dynamite 68 years ago. Yet ask a person to what we owe our great progress and you will receive many answers. Few, if any, will answer "high explosives," which some think are most important of all!

One of the largest blasts on record as caught by the camera. Over 220 tons of gelatine high explosives in the quarry of the Inland Lime & Stone Co., near Manistique, Mich., brought down 1,250,000 tons of well-fragmented stone. About 38 miles of Cordeau was used.

3/4 yd. LORAIN · 40
Moves 1469 yds. in 10 hrs.

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The RECORD and the MACHINE

Unit: 3/4 yd. L-40, owned by J. B. Towles, Lexington, Ky.
Job: 20,000 yds. of gravel pit borrow.
Height of Bank: Average 6 ft.
Degrees of Swing: 90° to 180°.
Hours Worked per Day: 10 hrs.
Average Yardage per Day: 870 yds.
Maximum Yardage per Day: 1469 yds.
Disposal of Material: All loaded to 2 and 3 ton trucks requiring about 11 ft. dumping clearance under dipper.

Discount, if you wish, the record of 1469 yds. in 10 hrs., as unusual—but the fact remains that in 23 days this unit moved 20,000 yds.—averaging 87 yds. per hr. dug and loaded to trucks. . . . The L-40 offers you 3/4 yd. output and profits at practically 1/2 yd. weight and costs—for the L-40 is built on the principle that Capacities depend on Stability and Strength, not Weight. . . . It handles an honest 3/4 yd. dipper at generous ranges; weighs 33,000 lbs.—yet it has the speed, power and endurance to turn out records like this and others detailed in the "Performance is Convincing" booklet. L-40 owners wrote it for you . . . Write for it.

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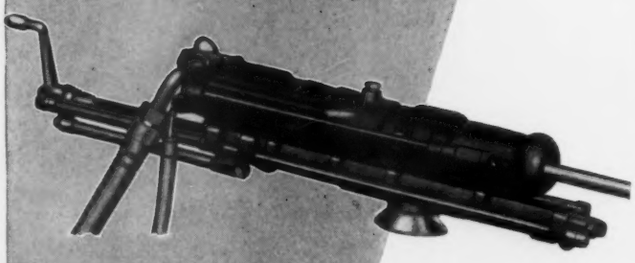
OTHER LORAINS

LORAIN-95 Big Dragline • 1½ yard Diesel LORAIN-77 • Truck Shovels & Cranes • 2 yard LORAIN-87

LORAINS—2 yd. to 3/8 yd.—Move More Material, Faster, at Less Cost

"MORE FOOTAGE PER SHIFT — *EVERY SHIFT*" Explains its POPULARITY



D-89B DRIFTER

SIX WORDS explain the preference for Gardner-Denver D-89B Drifters: *more footage per shift, every shift.* This ability to get more work done results from advanced design, reliability, ease of handling and approval by drill runners. Prove it for yourself—put Gardner-Denver D-89B Drills to work on *your* jobs.

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GOOD Design Materials Workmanship Value

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A Middleweight with a Heavyweight's Wallop

L-2 45 lb. Rock Drill

Sullivan's New L-2 gives big drill performance at small drill price. Increased production, easy operation, and low upkeep costs are the principal features. Try one.

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WITH DIESEL POWER
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LOOK at a line from which you can select any size with full Diesel engines as standard equipment — not near-Diesels, nor makeshifts, but husky, proved Diesels manufactured by the nation's leading engine builders.
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LOOK at a line in which less dead weight, lower inertia, plus higher Diesel power means continuous high production in every kind of digging. . . . Only P&H offers you a full line of shovels powered by Diesel as standard equipment. Diesel power plus the pacesetting P&H chain crowd plus new streamlined dippers plus many other outstanding improvements mean new production records for any P&H owner. Write today for information on the many features of the P&H Pacemakers for 1936.
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Gas engine power is also available, where desired, on any P&H machine.
No. 1 with plenty more to come
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P&H PACEMAKERS ··· FASTER IN THE FIELD

KOEHRING

251 5/8 yard

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Fast Operating Speeds — and light weight—two selective swing speeds and two travel speeds — only a few of the many outstanding operating features of the new Koehring 251.

Enclosed Gears — Anti-Friction Bearings — Heavy Duty Welded Construction—Koehring Chain Crowd, Positive Steering, Powerful Traction. The 251 is available as a Shovel, Crane, Dragline or Trench Hoe. Write for bulletin.

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WITH HUGS

● 1936 is a year for modernization—in methods and in equipment. Start your modernization program with your transportation equipment by putting Hugs on the job. Moving rock products with Hugs gives you greater mobility and flexibility—at lower cost per yard. You'll see the results in faster hauling of bigger pay loads and at less expense per mile.

Fast, low-cost moving of quarry and rock products on tough jobs calls for equipment specially built to meet the conditions. Ordinary dump trucks just won't do. You must have trucks with real guts—trucks that will come through every time, no matter how tough the conditions, and then race back for more.

Hugs have everything! They are especially built to meet and withstand the toughest conditions; they have the ruggedness needed for rock and dirt moving operations. Hugs stay on the job year after year!

Tell us about your transportation needs. Let our engineers study your individual requirements and recommend specially designed and built Hug equipment.

HUG

THE HUG COMPANY
572 Cypress Street • Highland, Illinois

BUILT TO MEET A CONDITION

Equip your Aggregate Plant to produce

STABILIZED MIX

Experimental stabilization plant at Midland, Michigan.

Views of one of Indiana's stabilization projects.

GOVERNMENT and state highway officials have established beyond question that the "stabilized" soil road is the road of the future. Here's a highway, built of local soil materials and Calcium Chloride that stands the traffic summer and winter, is dustless and smooth, yet costs little more than ordinary gravel—a boulevard for the price of an ordinary road.

The discovery of this new science of soil and Calcium Chloride composition presents the greatest business opportunity that aggregate producers have ever known. Now they can actually sell much of the finer aggregate and pit over-burden soils as well as the ordinary classified salable aggregates.

And a further good "break" for the aggregate producers in general is that most of them already have much, if not all, of the equipment needed to produce stabilized soil mix—the material which is without question the secondary road of the future.

Thousands of miles of Calcium Chloride stabilized road surfacing will be needed in 1936. Put yourself in position to supply it. Write for our bulletin number 24, just off the press, which tells you about this great new business opportunity.

Calcium Chloride maintains proper stability of soil mixtures by providing and regulating the supply of moisture necessary to give binder soils their adhesive properties.

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The Columbia Alkali Corporation • Barberton, Ohio
The Dow Chemical Company • • Midland, Michigan
Michigan Alkali Company, 60 E. 42nd St., New York City

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FOR STABILIZING ROAD SURFACES

Teniendo plena confianza en los productos Austin-Western, los contratistas enviaron estras trituradoras de piedra . . .

Lejos en el Interior Montañoso

Translation: **Having full confidence in Austin-Western equipment the contractors sent these crushers far into the mountainous interior.**

● When completed, the highway from Nuevo Laredo to Mexico City will be one of the world's most scenic highways. It traverses the wild mountainous country of Old Mexico.

Two years ago, an Austin-Western No. 100 Crushing Plant was transported more than 100 miles into the interior over trails almost impassable to an automobile. Six months later another No. 100 plant was purchased by the same contracting company—proof of their reliability and freedom from breakdowns.

Austin-Western gratefully acknowledges this spectacular testimonial to the reliability of its portable crushers. Getting them on location was in itself a major engineering feat. Contractors are unusually careful of their choice in such circumstances.

The dependability of the Austin-Western No. 100 Portable Crushing and Screening Plant with its large capacity is worthy of study for your jobs. Check possible savings it can make where haulage from fixed plants is a consideration. It is built to meet the growing demand for small sizes of stone now so generally used for road construction.

Austin-Western manufactures the most complete line of earth moving equipment. Because of this, its representatives can give you impartial advice on equipping for any job.

Above: Mexican Laborer.

Center: The Austin-Western Crushers were transported over 100 miles of this terrain.

Left: The No. 100 Portable Plant has a 9" x 40" primary roller bearing jaw crusher and an 18" x 38" roll (or 4" x 40" jaw) crusher for reduction crushing. All portable plants have oversize shafts and roller bearings throughout. Compact for easy transport on steel or pneumatic tired wheels, they can be set up for operation in a few hours. The Austin-Western Crusher Line also includes jaw and roll types.

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ROAD GRADERS · MOTOR GRADERS · ELEVATING GRADERS · DRAGS
ROAD ROLLERS · DUMP WAGONS · DUMP CARS
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The Austin-Western Road Machinery Co.
A-7, Aurora, Illinois
Please send details of the No. 100 Crushing and Screening Plant.

Name.....
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Quicker WELDING Better PENETRATION Longer WEAR

Weld manganese and carbon steel castings and forgings with . . .

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WELDING ROD

From every angle you'll get greater efficiency from TIMANG. It's easier for any welder to use because it flows freely and welds quicker . . . without affecting the metal close to the weld. And the finished weld will be as tough and strong . . . with the same resistance to wear . . . as the parent metal.

TIMANG is the original manganese steel welding rod . . . developed in TISCO laboratories . . . and now used extensively for repairing and building up manganese steel wearing parts and carbon steel forgings and castings.

TIMANG is sold direct and through sales organizations. Your jobber or distributor handles this rod . . . in some cases under a private trade name. Be sure you insist on the Taylor-Wharton product. Bulletins on request.

TISCO products include manganese steel pump parts, cutter heads, dippers, buckets, dipper teeth, racks and pinions, jaw plates, cheek plates, hammers, liners, mantles, screen cloth, perforated plate, grinding balls, etc.

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No Other Scrubber has This Action

Mass Weight of Material, causes mass pressure to disintegrate thoroughly without crushing or grinding.

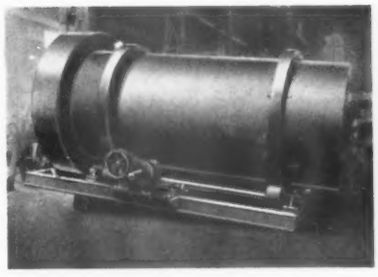
Violent Surging Action, produces numerous pressure contacts of each particle with the other.

High Speed, keeps the mass extremely live—greatly reduces the water required.

Conical Ends—assures a quick and positive feed and discharge—with a vertical and lateral circulation of the mass to speed up passage through drum.

No Internal Moving Parts,—no grates, elevating buckets, internal shafts or cutting blades means negligible maintenance, and low power costs.

No Other Washer has These Advantages



A Rolling Action—not a drag—thus you may forget maintenance.

A Squeeze Effect—forcing the fines to the surface for removal by counter-current action of the wash water.

Ample Settling Area—for the coarse particles to settle and be removed from fines and slime.

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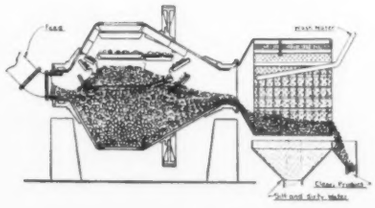
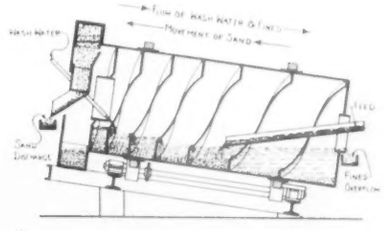
No Internal Moving Parts—to cause wear and shut-downs.





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WORK ON THE $3,000,000 Pine View Dam in Ogden Canyon, Utah, is being rapidly pushed to completion.

Mr. Len Malan, of the Wheelwright Construction Company, Ogden, reports, "We are using General Tires on the trucks for this construction job. Our particular task is the construction of highways on either side of the reservoir, including the excavation and relocation of the roads. This calls for moving thousands of cubic yards of dirt. General Tires are holding up well on the rough roadwork and have occasioned *no delays on the project.*"

Wherever the jobs are toughest, you'll find Generals. Your General Tire dealer has a complete, highly specialized line of truck tires. He is a practical truck tire man with wide experience and accurate knowledge in fitting the right type and size of tire to every kind of job. This combination is worth real money to you. Call him in.

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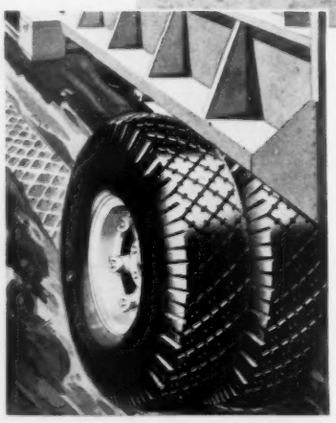
THE GENERAL HEAVY DUTY TRACTION BALLOON

is made to order for the toughest construction jobs. It is only one of the complete line of Generals—each designed and built specifically to do a certain job better.



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2. Generals are cooler tires—they flex uniformly without that heat-producing "hinging action" of ordinary breaker-strip tires.

3. Generals have "compact rubber" treads—their construction keeps the tread rubber compact and compressed so that it wears slowly and gives more miles.

FREE!

Read this booklet on how to avoid the more expensive tire troubles. Write to The General Tire and Rubber Co., Akron, O., in Canada—The General Tire and Rubber Co. of Canada, Ltd., Toronto, Ont.

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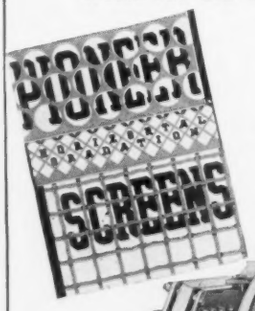
You want a screening plant that will increase your profits as much as 50% this year without adding to your cost of operation. By replacing your old screen with a PIONEER HORIZONTAL SCREEN, you will increase capacity, you will get more accurate sizing - at no increase in cost of operation. The result—GREATER PROFITS!

Write for the latest booklet which is just off the press, giving you complete information about various types of screens. No cost or obligation.



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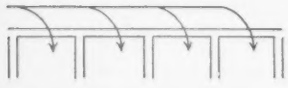

3. Every Opening is 100% Efficient

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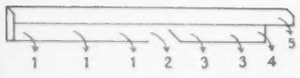
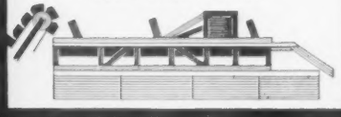
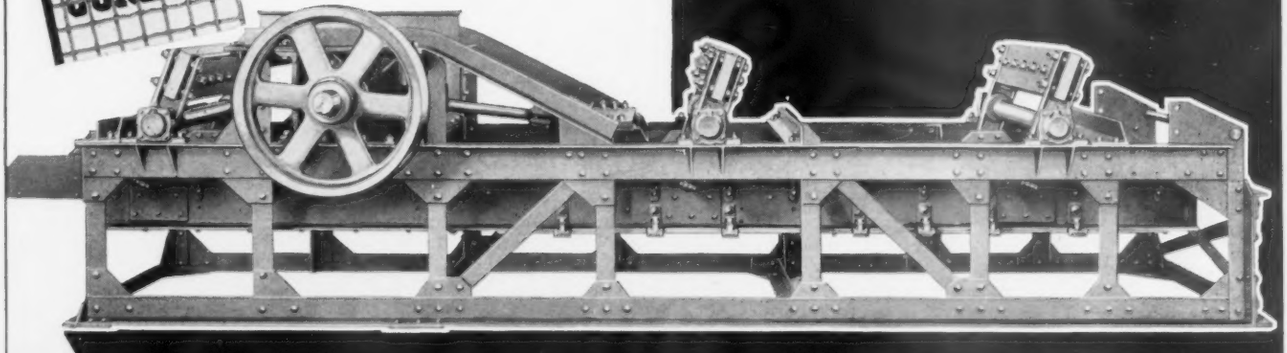


5. Counter-Balanced - No Vibration -





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Why don't you duplicate these results in your plant?

Ask for details of No. 19 Crusher, described in this letter.

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AT 32nd STREET
Manufacturers of
CRUSHING, MINING AND CEMENT MACHINERY
PULVERIZED COAL EQUIPMENT
PNEUMATIC TRANSPORT SYSTEMS
SCREENING, ELEVATING, CONVEYING, TRANSMISSION MACHINERY

January 1st, 1938

Subject:

Stone & Gravel Producers, Inc..
Anywhere,
U. S. A.

Gentlemen:

Is your plant equipped to produce minus 1/4" and plus 1/8" stone for top dressing, as well as 3/4", 1/2", 3/8" and 1/4" sizes? There is a great demand today for minus 1/4" and plus 1/8" material. Our little #19 gearless gyratory crusher for fine crushing will enable you to meet this demand.

A carefully conducted test was recently run on one of our #19 crushers operating on hard dolomite limestone 2½" oversize. This machine produced more than 25 tons an hour of minus 1/4" and plus 1/8" material. 20% was minus 1/8". This little #19 crusher is operated by a 25 HP motor. The actual power consumed is 21 HP. In the same plant they have one of our #25 crushers with a 25 H.P. synchronous motor built in the pulley. This machine produces 78 tons an hour when set to 7/8" on the closed side.

We have hundreds of customers who are getting equally good results. The performance described above is not unusual with our machines.

Getting double the capacity with 1/2 the power should be interesting to all people in the stone business.

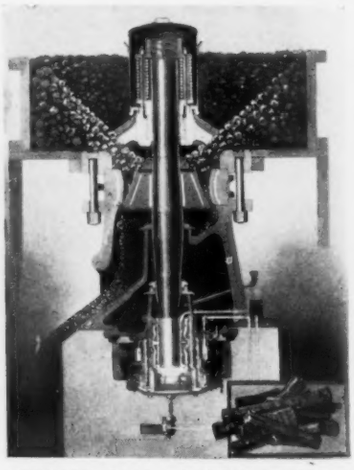
If you are interested and would like to have one of our sales engineers call on you to discuss this important subject, please wire at our expense. You will be under no obligation because of his call.

Very truly yours,

KENNEDY VAN SAUN MFG. & ENG. CORP.

J. E. Kennedy
President

JEK/p



KENNEDY BALL BEARING GEARLESS GYRATORY CRUSHER

The sensational performance of this efficient unit is attracting the attention of producers everywhere. Increased tonnage with incredible savings of 50% in power consumption and 80% in maintenance costs.

KENNEDY VIBRATING SCREEN

Specially adapted for scalping oversize from primary crushers, also for grading smaller sizes. Built open or enclosed, in widths of 3' to 6', and with one or more decks, for suspension or bottom support.

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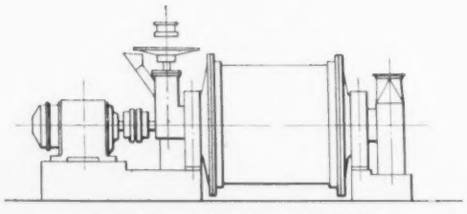
New Catalog No. 35-P-536
Sent Upon Request



KENNEDY GEARLESS TUBE MILL

For grinding limestone, minerals and the like, and for pulverizing coal for firing kilns and boilers.

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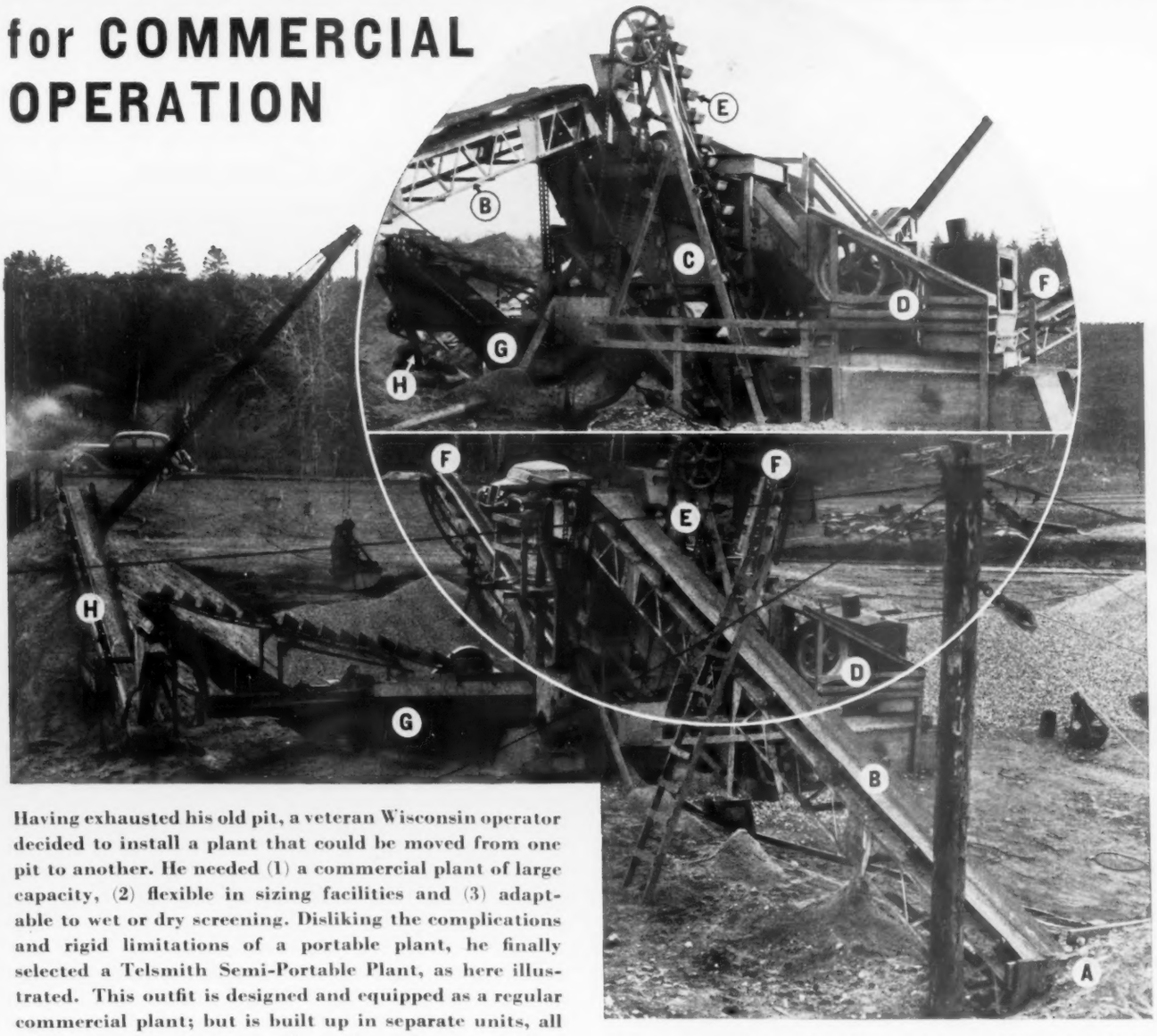
A SEMI-PORTABLE GRAVEL PLANT

for COMMERCIAL OPERATION



Having exhausted his old pit, a veteran Wisconsin operator decided to install a plant that could be moved from one pit to another. He needed (1) a commercial plant of large capacity, (2) flexible in sizing facilities and (3) adaptable to wet or dry screening. Disliking the complications and rigid limitations of a portable plant, he finally selected a Telsmith Semi-Portable Plant, as here illustrated. This outfit is designed and equipped as a regular commercial plant; but is built up in separate units, all readily movable by truck. No unit weighs over 7 tons. It can be operated as a dry screening plant during cold weather—handles big tonnages—makes three sizes—produces aggregate passing state highway specifications.

Telsmith builds rock crushing and gravel washing plants of all sizes—portable, semi-portable and stationary—varied to suit local conditions. The plant here described is but one example of Telsmith engineering, service and equipment. If interested in semi-portable plants for quarry or gravel plant use, send for Bulletin SG-15, covering semi-portable outfits. Just off the press and chockful of valuable information. No obligation.

A drag scraper brings the pit material to a 20 ft. x 3 ft. 4 in. Telsmith Portable Plate Feeder (A) which delivers to a 20 in. x 42 ft. Telsmith Portable Conveyor (B) discharging on a 3 x 8 Telsmith Triple-Deck Pulsator (C) where the water is added. All oversize goes to a 9 x 30 Telsmith-Wheeling roller bearing Jaw Crusher (D); and, after crushing, is returned to this screen by a Telsmith Chain Elevator (E) with 12 in. buckets. The Pulsator makes two sizes of gravel which are carried to stock piles by two 16 in. x 33 ft. Telsmith Portable Belt Conveyors (F). Water sprays above screen thoroughly rinse the gravel before going to conveyors. Sand passing third deck of screen is flumed to 30 in. x 16 ft. Telsmith Sand Drag (G), which, after scouring and dewatering, discharges to a 16 in. portable conveyor (H) and thence to stock pile. A 65 hp. gas engine with clutch and V-rope drive operates complete plant. Finished products are loaded into railroad cars or trucks by crane with clamshell bucket.

G1-36

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In plants such as these, and in hundreds of others, CP Diesels are consistently producing dependable power for ONE CENT per K.W.H.—or less!

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M-1-36

VOLUME 28 NUMBER 11

Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY
CHICAGO, MAY, 1936

CEMENT SHIPMENTS SOAR

Sales in March Up 46% Over Year Ago

IMPROVEMENT FELT ALL ALONG LINE

Shipments of Portland cement rose sharply in March, according to statistics released by the U. S. Bureau of Mines, climbing to 7,138,000 bbl., 46.3 per cent. above the corresponding month of last year. This is one of the best showings in many years and although actual figures are not available, aggregates, which form the other component of concrete, are certain to have shared a similar if not greater increase.

Production of cement in March, 1936, was 5,263,000 bbl., 22.4 per cent. greater than in March, 1935. Stocks at the mills experiences a decline of 1 per cent., since shipments exceeded production, dropping to 21,096,000 at the end of the month.

Total production of cement for the first quarter of 1936 amounts to 12,347,000 bbl. compared with 10,554,000 bbl. in the same period of last year, while the total shipments of cement for the months of January, February and March, 1936, amount to 14,183,000 bbl. compared with 10,675,000 in the same 1935 period. Expressed in percentages, production for the quarter is up 17 per cent. and shipments are 32.9 per cent. higher.

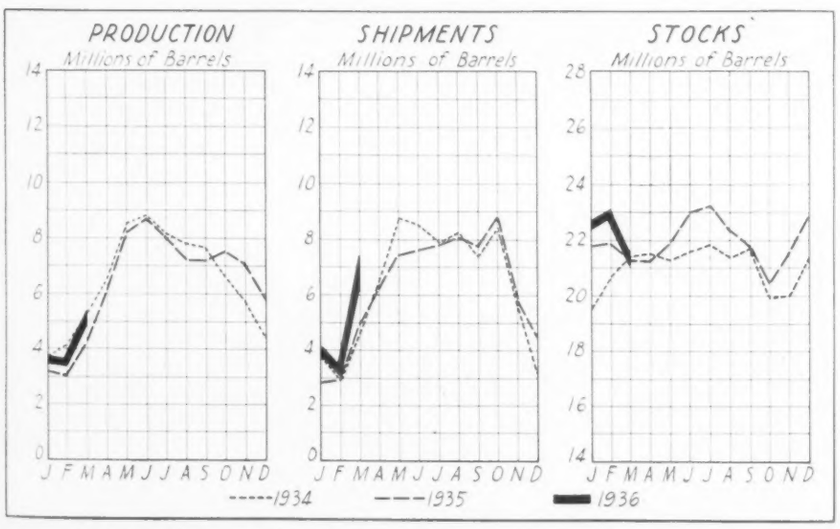
These statistics include reports from all plants operating in the United States with one exception.

Production in March, 1936, was 23.4 per cent. of capacity compared with a ratio of 18.9 per cent. a year ago. A year ago 162 plants were included in estimating capacity; this year 160 plants are used.

Steel Sand Barge Sunk in Ohio River Is Raised

The Iron City Sand & Gravel Co. of Pittsburgh, Pa., has raised a steel barge which, carrying 400 tons of sand, was sunk in the Ohio River near East Liverpool, O., early in April.

The barge was being pushed upstream by the towboat *Iron City* when it struck an obstruction. While the barge suffered little damage the cargo of sand valued at $400 was lost.



Production, shipments and stocks of Portland cement, January, 1934 to March, 1936.

Carloading Estimate Shows Upward Trend

SECOND QUARTER GAIN OVER 11%

Shipments of sand and gravel, crushed stone, cement, lime and plaster in the second quarter (April, May and June) of this year will be 11.2 per cent. higher than they were in the corresponding period of 1935, according to the estimate of the Regional Shippers' Advisory Boards, released during April.

Lime and plaster will show the best increase, it is indicated, rising from actual carloadings of 30,295 in the second 1935 quarter to an estimated 34,092 carloads in the 1936 period, or 12.5 per cent.

Sand, gravel and stone shipments in the 1935 period were 275,301 cars, while for the second quarter in 1936 the Board estimates loadings will be 302,582 cars, 27,281 more than a year ago, or 9.9 per cent.

Cement shipments in April, May and June, 1935, reached 96,963 carloads. In the comparable period this year loadings will reach 107,887 cars, or an increase of 11.3 per cent., it is estimated.

Massachusetts Firm Will Develop Phosphate Lands

★ The South Carolina Board of Phosphate Commissioners of which A. J. Beattie, Columbia, S. C., is secretary is considering the application of an unnamed Massachusetts concern for the development of an extensive deposit at Beaufort, S. C.

The company, following the expected approval of its application, will spend $600,000 in plant and equipment, it is reported.

★ Quillin Bros., operators of three sand-and-gravel plants in northeastern Ohio, recently purchased an Osgood ¾-cu.yd. Commander shovel for use in their operations at Lodi, O.

1936 Handbook New Both Inside and Out

TWO COMPLETE CHAPTERS ARE ADDED

Besides being brightly arrayed in a new cover of orange and black inks printed on bright green cloth, the new 1936 edition of PIT AND QUARRY HANDBOOK embodies unusually extensive additions and revisions. Approximately 50 more pages have been added to this, the 29th edition, much of this space being devoted to new material added to the various sections. The total number of pages is 792.

Each chapter has been subjected to critical study and the revisions that have been made reflect the latest approved practices in the recovery and processing of nonmetallic minerals. In one chapter alone—*Burning and Cooling*—six pages have been added to describe and illustrate new cooling, burning and sealing devices. The section on *Electrical Equipment* has been enlarged to provide for recent developments in gearmotors, fan-cooled and splash-proof motors.

Producers have become so aroused over the bituminizing of aggregate for road purposes that a chapter on this subject has been added. Problems in treating crushed stone and gravel with bituminous mixtures and the opportunities for producers in adding this function to their regular operations are described in detail.

Another new chapter is that on *Electric-Arc Welding*. It discusses the three purposes for which welding is employed: (1) fabricating, (2) repairing and (3) hard surfacing.

The *Directory* has, of course, been painstakingly revised and while many listings have been removed, a greater number of new names have been added, so that the new directory is larger than the one of 1935.

While general distribution of the volume has already been made, copies are still available at $10.00 each, postpaid.

Solvay Obtains $100,000 Option on Stone Deposit

The Solvay Process Corp. of New York, N. Y., has paid $100,000 in cash for an option on the Winnfield, La., properties of the Louisiana Lime Products Corp., with June 5, 1936, set as the final date for exercising the option.

Under the terms of the deal, the Solvay company is to take core-drill samples from the Winnfield deposit. Then, if the engineers and appraisers determine that more than four million tons of limestone are available, the purchase price is to be $550,000. If less than four million tons are found to exist, the properties are to be sold for $350,000. In either case the option cash is to be applied on the purchase price.

Negotiations for the deal were carried out between Wm. C. Woolf, president of the Louisiana company, and J. H. Kahn, secretary of the Solvay firm. Under the terms, all land consisting of 1100 acres, railway trackage, machinery and plant will be transferred.

Hear Oral Arguments on Surcharge Case May 20

Oral arguments on the application of Class I railroads that the emergency freight surcharges scheduled to expire July 1 of this year, be continued indefinitely will be heard May 20, according to an announcement made during April by the Interstate Commerce Commission at Washington, D. C.

Testimony has been given at the capital and at various cities throughout the country during recent weeks. The aggregates industries were represented by V. P. Ahearn, executive secretary of the National Sand and Gravel Assn., whose testimony has already been presented, having been reprinted, in part, in the April issue of PIT AND QUARRY.

Other recent developments in this matter, in which all producers are intensely interested just at present, will be found in the department devoted to "Traffic News and Comment," on page 74 of this issue.

New Gravel Plant to be Erected near Lacon, Ill.

★ The Kingston Lake Gravel Co., Mapleton, Ill., has leased deposits at Lacon, Ill., and will start the erection shortly of a new, modern sand-and-gravel plant designed by the W. H. K. Bennett Co., Chicago.

Power lines have been erected to the site of the new operation. According to George Childs, president, most of the finished material will be delivered by barge and towboats *via* the Illinois River.

West Coast Borax Firm Developing Talc Deposit

A large body of talc is being developed near Randsburg, Cal., by the West Coast Borax Co., according to advice from the Pacific Coast. Two miles of road have been built to the property, storage bins have been erected and machinery for processing the talc is being erected. The company expects to start shipping material by June 1, loading out from 150 to 200 tons daily.

★ A Rotex double-deck screen, 10 ft. by 40 in., was installed during April in the Copley, O., crushing plant of the Minnesota Mining & Manufacturing Co. of St. Paul, Minn.

★ A new Marion 450 shovel has gone into operation at the quarry of the Alpha Portland Cement Co., at Manheim, W. Va.

Producer in Vermont Taps Rich Resource

IMPROVES TALC, GAINS BY-PRODUCT

Coöperative work between the United States Bureau of Mines and the Eastern Magnesia Talc Co., Burlington, Vt., seems to have tapped a new source of profit for the company and a new national resource as well.

The company has been milling what was supposed to be a talc-dolomite mixture, the soft talc being sold to paper makers and the hard residue, or tailings, to prepared roofing manufacturers—whenever they would take it. Paper makers complained of an excess of lime in the talc and, desiring to eliminate this objection and to improve the grade of the product generally, the manager talked over his problems with a member of the Bureau of Mines staff who chanced to visit the plant. The possibility of beneficiating at least a portion of the product was discussed and the question of the feasibility of flotation was suggested. Eventually samples of the material were sent to the Bureau's station at Rolla, Mo. Tests showed that the talc could be separated by flotation and that a really high-grade talc product could be made—possibly as good as the expensive talcs that hitherto have had to be imported. Italian and French talc fetch several times as much as the domestic product due not only to superior color and fineness but to better "slip" or feel.

Improvement of the talc product, however, was not the only result of this work. The tailings from flotation were found to consist not of dolomite as had been supposed but of high-grade magnesite. The paper makers who had complained of excess "lime" accordingly found that their troubles could not have come from impurities in the talc but were traceable to other causes. Finally, it appears that from 6,000 to 10,000 tons of reasonably pure crude magnesite, all ground through 60-mesh, can be put on the market annually at very small cost f.o.b. plant. This magnesite may be mixed with dolomite and made into high-grade refractories to compete with material imported from Canada, it may be sintered alone (or with a small iron-ore admixture) into dead-burned or grain magnesite, it may be calcined for use in stucco or flooring, or it may be employed for making epsom salt, technical carbonate, or other chemical compounds. For these potential uses it can displace imported magnesite.

This development should bear fruit before next fall, and experimental work is now being concluded, according to E. W. Magnus, vice-president of the Eastern Magnesia Talc Co. Main offices of the company are located at Burlington, Vt., while four mines and mills are operated in the state at East Granville, Johnson, Rochester and Waterbury.

N. C. S. A. Executives Tour Through South

BOYD, GOLDBECK CONDUCT MEETINGS

Leaving Washington, D. C., on April 19, Engineering Director A. T. Goldbeck and Administrative Director J. R. Boyd of the National Crushed Stone Assn., made an extensive trip through the southeast, southwest and middle-west for the purpose of acquainting crushed-stone producers with the activities and accomplishments of the National Crushed Stone Assn., and to give these officials opportunity of obtaining first-hand information with regard to specific problems affecting the industry existing in the various territories visited. An additional feature of the trip was to give Mr. Goldbeck an opportunity of contacting various state and county highway officials on matters of mutual interest with specific regard to problems affecting the crushed-stone industry.

The first stop was Columbia, S. C., where a meeting of the producers in that area was scheduled for April 20 under the supervision of Regional Vice-President T. I. Weston. College Station, Texas, was the second stop, where Mr. Goldbeck addressed the Twelfth Annual Highway Short Course given at the Texas A. & M. College, on April 24. The party then proceeded to Austin, Tex., where on April 25 officials of the Texas State Highway Department were contacted and a visit made to the state highway testing laboratory. Regional Vice-President E. Eikel for the Southwestern Region and W. F. Wise, former president of the association, handled the Texas arrangements. An April 27 a meeting was held in Kansas City, Mo., under the auspices of Carl Hise, secretary-treasurer, Missouri Aggregate Assn. Meetings were also scheduled for St. Louis, Mo., on April 28, with arrangements in charge of E. J. Krause and Ralph E. McLean; in Nashville, Tenn., on April 29, and Louisville, Ky., on April 30, under the supervision of H. E. Rodes, president of the association; in Columbus, O., on May 1, with Russell Rarey, in charge of arrangements, and concluding with a visit to Pittsburgh, Pa., on May 4.

Portland-Cement Safety Meet Held at Columbus

More than 100 men from Portland-cement mills in Ohio attended another of the nation-wide series of cement safety meetings at the Deshler Wallick hotel, Columbus, O., April 16. The meetings are being arranged by the Portland Cement Assn.

H. Vanderwerp, vice president of the Medusa Portland Cement Co., Cleveland, O., was general chairman and presided at the morning session. The afternoon session was presided over by R. W. McAllister, superintendent of the Columbia cement plant, Pittsburgh Plate Glass Co., Zanesville, O. Guests and special speakers included John F. Magee, vice president, Alpha Portland Cement Co., Easton, Pa.; Thomas P. Kearns, superintendent, division of safety and hygiene, Ohio Industrial Commission; A. J. R. Curtis, Chicago, in charge of safety activities of the Portland Cement Assn., and C. W. Owings, Pittsburgh, Pa., associate mine engineer, U. S. Bureau of Mines.

The program included an analysis of the causes of some typical mill accidents of recent occurrence; methods of correcting unsafe practices; lessons taught by safety records, and suggestions for making plant safety rules more effective.

Atlas Olympia Co. Adds More Storage Equipment

★ Approximately $5,000 worth of new equipment for storage facilities has been installed in the crushed-rock plant of the Atlas Olympia Co. of California at Oakdale, Cal., according to R. L. Robinson, manager.

The machinery includes a hoist and scraper outfit. The new equipment will enable the Atlas company to handle raw storage of material after it has been dug out and before it is processed.

Fluorspar Conference at Rosiclare, Ill., May 22

A conference on "New Trends in the Utilization of Fluorspar" will be held at Rosiclare, Ill., on May 22.

As stated by Dr. M. M. Leighton, Illinois state geologist, the purpose of the conference is to reveal to all who are interested in the mining and use of fluorspar the character of researches now in progress, which are expected to bring to light new uses and widen the market field for this mineral, which is extensively used in the steel, aluminum and chemical industries.

The conference at Rosiclare, in the heart of the fluorspar mining area, will be sponsored jointly by the Illinois State Geological Survey, the United States Geological Survey, and the fluorspar producers of the Illinois-Kentucky district.

Rock-Wool Men Building New Plant at Pittsburgh

James D. McCarty, assistant manager, and Charles D. Richardson, superintendent of the General Insulating & Manufacturing Co., Alexandria, Ind., producers of rock wool, have resigned and gone to Pittsburgh, Pa., where they are establishing their own rock-wool plant at Springdale, a suburb. The new plant will begin blowing the various forms of rock wool from molten stone early this summer, it is said.

Chemical Lime Firm Will Spend $600,000

GETS R.F.C. LOAN FOR IMPROVEMENTS

Approximately $600,000 is being spent by the Chemical Lime Co. at Bellefonte, Pa., in carrying out the extensive improvement program mentioned in the April issue of PIT AND QUARRY. A modern rotary-kiln lime plant is being constructed and raw material will be obtained from a stone deposit recently acquired which adjoins the old workings of the company. Stone is to be mined by the underground method.

In financing the improvement the company, which recently was reorganized, obtained a half-million dollar loan from the Reconstruction Finance Corp. and $100,000 is being added by the company itself.

New officers of the Chemical Lime Co. are: Willard L. Case, president; Robert S. Walker, vice-president and general manager; Thomas Brown, vice-president in charge of sales; W. J. Emerick, treasurer; and Robert M. Gehret, secretary. Mr. Brown is in charge of the erection of the new lime plant and Swengel Smith will be general superintendent of the operation.

Light-Weight Aggregate Made from Molten Slag

The Superock Co., an Alabama corporation, has located at Birmingham for the purpose of converting blast-furnace slag into a light-weight aggregate for concrete. The plant is in operation and offices have been established in the Empire Building.

A plant has been built by the Republic Steel Corp. at Birmingham which will be used in the manufacture of the by-product. The slag is poured into the machine and is almost instantly converted into a light aggregate.

C. S. Robinson is president of the company and G. O. Greene secretary-treasurer.

Birmingham is said to be the first city in the United States where the product is to be manufactured for the general market. Plants have been set up in Chicago and Pittsburgh but their output is consumed by one organization. The Birmingham plant will have a capacity of 800 tons a day.

Spends $100,000 for New Dolomite Plant in Ohio

★ Stone obtained from the workings of the old Gibsonburg Lime Products Co. at Gibsonburg, O., will be employed in a new plant for refining dolomite now being constructed by the Slusser Dolomite Co. The buildings and equipment represent an investment of approximately $100,000.

New Detroit Concern Starts on Lime Plant

NICHOLSON HEADS BELLE ISLE CO.

The new Belle Isle Lime Co., Detroit, Mich., has started on its modern lime and lime-products plant on the Detroit River at the foot of St. Jean Ave. on a three-acre tract recently purchased. The operation is expected to go into production about July 1.

When the plant building is completed, equipment from the Campbell Stone Co. plant at Afton, Mich., will be moved to Detroit and installed. The capacity will be 300 tons a day. A slip running to the river will enable boats bringing in limestone to be unloaded on the property. Vessels of 10,000 tons capacity operated by the Valley Camp Steamship Co. will deliver the raw material. There is a Detroit Terminal Railroad siding on the property which will facilitate shipment of the finished product.

Officers of the Belle Isle Lime Co. are George J. Nicholson, president and treasurer; Calvin A. Campbell, vice-president; and Theron C. Taylor, secretary and general manager.

The company will obtain its stone from the quarry of the Inland Lime & Stone Co., Manistique, Mich., Mr. Nicholson being connected with the Inland company.

The plant will consist of two 100-ft. rotary kilns equipped with pre-heaters and soaking pits. Petroleum coke or pitch will be used as fuel. The preheaters and soaking pits were designed by Mr. Taylor. A complete hydrating plant with a capacity of 100 tons daily is a part of the equipment.

Mr. Nicholson, president of the company, has spent his business career in the lime business, having been vice-president of the White Marble Lime Co., later succeeded by the Manistique Lime & Stone Co. and this by the Inland Lime & Stone Co.

Mr. Taylor has spent many years in the sales end of the lime business, representing the Campbell Stone Co. Prior to that he was combustion engineer of the Ford Motor Co. and has had a large amount of experience in combustion problems.

Mr. Campbell is general counsel for the Dow Chemical Co., Midland, Mich., and is a son of the late Senator Calvin A. Campbell.

★ The Consolidated Feldspar Co., Baltimore, Md., is reported to be considering the erection of a crushing and treating plant for feldspar at the corner of First and Water streets. The installation will represent an investment in the neighborhood of $100,000.

★ The Michigan Alkali Co., Wyandotte, Mich., recently installed two Schaffer poidometers and two Kritzer hydrators.

After the recent flood on the Ohio River had receded, thousands of tons of mud were left on the property of the Tri-State Asphalt Co., Martins Ferry, O. The stock-pile in the background distinctly shows the high-water mark. Below is shown a 10,000-gal. storage tank. When the water began to rise, workmen moored the tank to the railroad track. Otherwise it would have floated away.

N. Y. Trap Rock Reports Operating Loss in 1935

Report of the New York Trap Rock Corp. and subsidiaries for the year ended December 31, 1935, shows net loss of $264,323 after interest, Federal taxes, provision for doubtful accounts, depreciation, depletion and minority interest. This compares with net income of $2,691 equivalent to 30c. a share on 9,010 no-par shares of preferred stock in 1934.

Total assets as of December 31, 1935, were $16,675,465 comparing with $16,886,857 at the end of 1934 and profit-and-loss surplus was $3,961,250 against $4,312,695. Current assets, including $307,822 cash, amounted to $1,459,107 and current liabilities were $374,727. This compares with cash and marketable securities of $348,354, current assets of $1,384,126 and current liabilities of $302,304, at the end of the preceding year. Funded debt as of December 31, last, amounted to $5,159,000 against $5,260,000 at close of 1934.

Activities of Phosphate Rock Institute Dropped

Announcement is made by the Phosphate Rock Institute that the New York office of the Institute has been closed and that future communications of interest to the members should be addressed to the president, John T. Burrows, 61 Broadway, New York, N. Y. The action to close the office and discontinue its activities followed resolutions adopted at a recent meeting.

Construction Volume Up Despite Floods

FIGURES SHOW CONTINUED GAINS

March construction records, despite a cold winter and harsh floods, showed a total value 40 per cent. higher than was reported for February and about 62 per cent. ahead of the March, 1935 volume. According to figures of F. W. Dodge Corp., covering the 37 eastern states, March construction contracts totaled $199,028,300 as compared with $142,050,200 for February and only $122,940,500 for March, 1935.

Increases in construction were shown for residential and non-residential building as well as for heavy engineering types. Gains over last year were well distributed geographically, with each of the 13 major districts east of the Rocky Mountains participating, except the New Orleans territory (Mississippi and Louisiana). Increases in construction as compared with February, 1936, totals were shown for each district except New England where flood conditions were severe, and in the New Orleans territory.

For the first quarter of 1936 total contracts for all classes of construction in the 37 states as a whole amounted to $545,871,300 as against only $297,761,500 for the corresponding quarter of 1935.

Operations of Monolith in 1935 Yielded Profit

Consolidated profit and loss account of Monolith Portland Cement Co. and subsidiary companies shows a net profit of $38,717.61 for the year closing December 31, 1935, after all charges, including Federal income tax.

At the stockholders' meeting the board of directors was reëlected. The consolidated balance sheet shows current assets of $1,035,740.73, against current liabilities of $232,162.61.

Long Exposure Required for Silicosis to Develop

Minimum exposure of 2½ years and an average exposure of 13 years to silica dust is required in the development of silicosis to the stage where it can be diagnosed as such, according to experience in the South African mines, Dr. R. R. Sayres, U. S. Public Health Service, told the occupational disease forum held in connection with the Seventh Greater New York Safety Conference early in March.

Dr. Sayres declared that there were a few isolated cases of silicosis resulting from exposure of 18 months, but that these cases were rare.

★ A 16-in. by 16-in. New Holland roll-crusher is being installed this spring in the plant of the Middletown Sand & Gravel Co., Middletown, O.

A.S.T.M. Gathering to Embrace 20 Sessions

MEET AT ATLANTIC CITY JUNE 29

A large number of technical papers and reports are scheduled for presentation during the 1936 annual meeting of the American Society for Testing Materials, to be held in Atlantic City at Chalfonte-Haddon Hall, from June 29 to July 3, inclusive. In order to provide ample time for the presentation of the papers and for discussion, some 20 sessions are being scheduled.

Two sessions are scheduled on cement and concrete. They will feature papers dealing with a hydrometer method for determining the fineness of Portland and puzzuolan cements, new data on the hardening of cement mortars, rating characteristics of fresh concrete, effect of testing speed on strength and elastic properties of concrete, the relationship between the elastic properties and linear change of stone in the natural state to concrete specimens containing the same stone, and the cone method for determining the absorption by sand.

Employ Lime to Process Waste Sulphite Liquors

In accordance with methods developed and patented by the Marathon Paper Mills, Rothschild, Wis., and its consultant Guy C. Howard, lime will be used to process waste sulphite liquor into a wide variety of products.

The waste liquor collected from blow-pits will be treated by the Howard process, a precipitation treatment with lime. This will yield a lime-sulphur product for use by the pulp mill in making fresh cooking acid, and a lignin product for use by the mill as a boiler fuel or to be utilized as a chemical raw material. In addition, there will result a process effluent sufficiently pure to permit discharging into the Wisconsin River without danger of pollution.

Recuperators Installed in Medusa Cement Plant

★ Two Vanderwerp recuperators, designed and produced by the Manitowoc Engineering Works, Manitowoc, Wis., have recently been installed in the Wampum, Pa., plant of the Medusa Portland Cement Co.

Fleet of Rex Mixers Is Sold to Philadelphia Co.

An item published in the March issue regarding the new ready-mixed concrete plant of the Liberty Corp., Philadelphia, Pa., stated that Blaw Knox truck mixers were used to mix and deliver the product. This was an error, as pointed out by Theo. Hanau, sales manager of Service Supply Corp., Philadelphia. Mr. Hamm sold the company six new Rex truck mixers in 1935 and has received an order for six additional Rex units, built by the Chain Belt Co., Milwaukee, Wis., this season.

New Sand-Dredging Firm in Operation at Chicago

The Marine Sand Co., organized in Chicago, Ill., recently with offices at 131 E. River St., is operating the steam dredge *American* in Lake Michigan producing lake sand for the wholesale market. The vessel has been bringing in two loads daily from the shoals, according to John Reading, general manager. Mr. Reading was formerly general superintendent and chief engineer of the Winkworth Fuel & Supply Co., sand-and-gravel producer of Detroit, Mich.

Other officers of the Marine Sand Co. are Charles C. West, president; James Alder, vice-president, and Fred Pieska, secretary-treasurer.

Cement Men Participate in Chicago Safety Meet

Participating in the program in connection with the fourteenth annual Midwest Safety Conference held May 5, 6 and 7 at the Stevens Hotel, Chicago, Ill., were Gordon Huth, safety director, Universal Atlas Cement Co., and F. E. Town, superintendent, Manitowoc Portland Cement Co.

At the occupational-disease session, M. I. Dorfan, manager of the dust-collection division of the Blaw-Knox Co., and Dr. R. R. Sayres of the U. S. Public Health Service, were the principal speakers.

Illinois Constructs 382 Miles of Concrete Road

Illinois stands at the top of the list in the mileage of concrete roads built in 1935, having constructed the equivalent of 382 miles of 18-ft. pavement, according to the American Road Builders' Assn. A total of 2,476 miles of concrete highways were built in all states during the year.

Gravel and crushed-stone road mileage built on the state systems during the year totaled 10,838, while 5,126 miles of various types of bituminous surface were laid.

Buys New Gravel Barge For Use on Wabash River

★ Peter Westergard, new owner of the Maunie Sand & Gravel Co., Maunie, Ill., reports prospects for a heavy demand for road gravel in his territory this year. In preparation for larger output from his plant at Maunie he has bought a new barge that is said to be the largest operating on the Wabash River. It is 106 ft. long and has a capcity of 200 cu. yd. of gravel.

Radio Talks Succeed in Selling Limestone

OREGON FARMERS BUY AS RESULT

"This is radio station K E X, Portland, Oregon. We will now bring you one of a series of 15-minute programs sponsored by Limestone Products, Inc. of Dallas, Ore., makers of Dallas ground limestone, Oregon's foundation rock of permanent agriculture and its lowest-cost soil sweetener. First we bring you several request numbers of "hill-billy" music. . . ."

The radio has proved profitable in moving agricultural limestone in Oregon, according to Norris B. Stone of Bowne & Stone, Portland, Ore., selling agents for Limestone Products, Inc. Mr. Stone, as the accompanying reproduction of a piece of advertising

"WE SOLD
a year's production of Limestone
in 7 months through our KEX program
says NORRIS B STONE
Bowne & Stone, Sales Agents for Dallas Ground Limestone
OREGON'S most powerful radio station proved a "natural" for Limestone Products Company. The excellent NBC programs plus broadcasts dealing with community interests are eagerly awaited by farmers of this section. These people buy limestone for their soil—and how they did buy it when KEX was put on the job. "Our entire season's output was sold in seven months. This record is entirely due to our KEX broadcasts, as this was the only advertising done," says Norris B Stone. KEX commands a tremendous audience in one of America's richest markets. In addition to NBC programs, it broadcasts all important civic and sectional affairs—and all major sports events including boxing, wrestling, hockey, baseball and horse racing exclusively.
KEX is operated by Portland's fastest growing newspaper—THE OREGONIAN
Read the KEX booklet before media lists are prepared. It tells how to crack this rich market—economically.
Oregon's Most Powerful Station
Tune in your advertising plans with KEX
KEX
KEX

from radio station K E X quotes him, sold a year's production in seven months through the little chats with farmers over the station. More than 200 separate broadcasts have been carried over the air waves, according to Mr. Stone, and the series proved popular and worthwhile since it sold the goods.

After the opening announcement, one or two recorded musical selections, usually "hill-billy" tunes or old-time favorites, were played. Then came a short selling talk of the "folksy" type, followed by another brief musical interlude and the closing announcement and appeal to buy.

Limestone Products, Inc., operates its plant and quarry a short distance southwest of Dallas, Ore.

★ New Marion shovels recently began excavating rock at the Silica, O., and Marion, O., quarries of the France Stone Co.

Attack Problems of Silicosis at Parley

LARGE GROUP MEETS AT CAPITAL

In response to an invitation from Frances Perkins, Secretary of Labor, approximately 200 representatives of all the important groups interested either directly or indirectly in the silicosis problem gathered at the Department of Labor, Washington, D. C., on April 14, to give further consideration to the development of plans for a national conference to be held in Washington later in the year. The intense interest manifested by those present clearly indicates a strong desire to pool information in a constructive effort towards a solution of the problem.

The group has been designated as the National Silicosis Conference Committee. Preliminary to holding a national conference it was deemed advisable to establish a number of subcommittees of the National Conference Committee, each of which would deal with a specific phase of the silicosis problem. Accordingly the following four general committees were designated: (1) Committee on the Prevention of Silicosis through Medical Control; (2) Committee on the Prevention of Silicosis through Engineering Control; (3) Committee on the Economic, Legal, and Insurance Phases of the Silicosis Problem; (4) Committee on Regulatory and Administrative Phases of the Silicosis Problem.

A definite program of activities has been assigned to each of these subcommittees.

Comparison of Abrasive Tests Are in Progress

Many aggregate producers, especially those who follow closely the activities of A. S. T. M. Committees D-4 on Road and Paving Materials and C-9 on Concrete and Concrete Aggregates, will be interested in a research program sponsored by the Project Committee on Correlation of Research in Mineral Aggregates, a division of the Highway Research Board of the National Research Council. This work involves a coöperative investigation involving comparisons of the Los Angeles and Deval abrasion tests of aggregate.

Considerable work has been done on the problem and at its recent meeting in Washington the Project Committee reviewed the data which have been submitted by the cooperating agencies.

The data indicates that although individual laboratories have little difficulty in duplicating results, there are certain details of the Los Angeles machine which if not standardized may cause variation of results between different laboratories. Cooperating organizations will study this phase and also a number of check tests on identical samples are to be made by several laboratories. At the 1935 A. S. T. M. meeting an interesting paper was presented by D. O. Woolf and D. G. Runner of the Bureau of Public Roads on *The Los Angeles Abrasion Machine for Determining the Quality of Coarse Aggregate*. A. S. T. M. Committees D-4 and C-9 which have been investigating the problem decided in view of the progress already made to publish as information a proposed method of test for abrasion of coarse aggregates based on the use of the Los Angeles machine.

It is believed this test will eventually be substituted for the Standard Method of Test for Abrasion of Rock (D2-33) similar in almost all respects to the Deval abrasion test. Much of the work indicates that the Los Angeles test furnishes results which correlate better with the service behavior of aggregates in certain construction than do those resulting from the Deval test.

Yosemite Cement Making Recapitalization Plans

Plans for a capital reorganization of the Yosemite Portland Cement Corp. will be presented to stockholders early in July with the intention of clearing preferred dividend arrearages of $1,640,000 from the books and placing the company in a position to pay current dividends on the present class "A" stock.

The company reported 1935 net profit of $54,361. This compares with net losses of $34,080 for the previous year and $70,169 for 1933.

Slate Industry Staged Sharp Recovery in 1935

The slate industry staged a decided recovery in 1935. Preliminary figures compiled by the U. S. Bureau of Mines show an increase of 39 per cent. in quantity and 34 per cent. in value compared with 1934. Increased building activity is reflected in a 60 per cent. gain in the number of squares of roofing slate sold. The gain in this commodity in 1935 paralleled almost exactly the increase in floor space of residential construction shown in F. W. Dodge Corp. reports. Prices of roofing slate were much lower in 1935 than in 1934, but mill stock prices were a little higher.

International Earnings Show Substantial Gains

First-quarter earnings of International Cement Corp. this year were $468,304, or four times as great as in the same period in 1935, when net profits were $115,601. This is equal to 71c. per share on 656,740 shares outstanding, compared to 18c. per share on 626,278 shares in the 1935 quarter.

According to President C. L. Hogan, earnings of South American subsidiaries are included at market-exchange rates.

10-Year Diversion of Road Funds Revealed

$545,000,000 TAKEN FOR OTHER USES

Gasoline taxes and motor vehicle registration fees used for other than highway purposes from 1924 through 1934 amounted to $545,000,000. These figures only take into account diversion by states. Funds turned over to counties and townships have also been diverted in many instances. Diversion by years is estimated as follows:

1925	$ 14,000,000
1926	13,000,000
1927	15,000,000
1928	25,000,000
1929	31,000,000
1930	37,000,000
1931	50,000,000
1932	100,000,000
1933	124,000,000
1934	136,000,000
Total	$545,000,000

The use of highway funds for direct relief has caused the rapid increase in diversion during recent years. The Hayden-Cartwright Act with its penalty clause and the resumption of Federal Aid requiring the conservation of funds for matching purposes should cause reduction in 1935 and 1936.

In 1934 there were 34 states in the diversion column. Of these, 20 accounted for $131,000,000 of the total $136,000,000, so the remaining 14 states were not serious offenders and diversion in these states in most instances provides for the maintenance of the state police force.

States where diversion reached major proportions in 1934 include:

Colorado	$ 2,793,000
Florida	6,307,000
Georgia	2,386,000
Illinois	8,558,000
Indiana	1,913,000
Louisiana	1,782,000
Maryland	985,000
Massachusetts	10,000,000
Michigan	806,000
New Jersey	4,056,000
New York	54,581,000
North Carolina	1,000,000
Ohio	10,463,000
Oklahoma	3,181,000
Pennsylvania	5,421,000
South Dakota	1,907,000
Tennessee	1,994,000
Texas	7,887,000
Washington	948,000
Wisconsin	4,576,000
Total	$131,544,000

There is definite information that there will be diversion of funds in at least 10 of these states in 1936.

★ Material-handling facilities at the silica operations of the White Rock Silica Co. at Brownstown, Wis., were recently improved by the addition of a new Osgood 1-cu.yd. combination shovel and drag-line.

Seismograph Useful in Locating Deposits

GOVERNMENT METHODS ARE DESCRIBED

Two novel instruments, embodying distinctly different principles but both used to determine the character of the materials under the surface of the earth were on exhibit at the Joint Exposition of the Manufacturers' Division of the National Crushed Stone Assn. and the National Sand & Gravel Assn. at the Hotel Jefferson in St. Louis in January.

These scientific devices, which were recently developed by the U. S. Bureau of Public Roads, are designed to assist in the location of rock and gravel deposits and other surfacing materials, in foundation exploration, and also in classifying excavation in highway construction.

The two methods by which these results are obtained are known respectively as the electrical resistivity method and the seismic method. In the former method the ordinary procedure is to introduce an electric current into the ground through suitably placed electrodes and by means of other electrodes to measure the average resistivity of a zone of earth comparable in dimensions to the electrode spacing. By progressively increasing the electrode spacing and repeating the measurements a curve is established which shows the relation of resistivity to depth. An upward trend of the curve indicates increasing resistivity with depth and suggests the presence of rock or some other material of relatively electrical resistivity, while a flat or descending curve is indicative of soil or clay. An abrupt inflection in the curve indicates a change of material at a depth approximately equal to the electrode spacing at which the change occurs.

In employing the seismic method of test a small charge of dynamite is placed in the earth and exploded under controlled conditions. The resulting sound waves traveling through the earth are picked up at several locations by sensitive detectors and their time of travel and other characteristics are recorded on a moving photographic film. Since such waves travel through consolidated rock at a rate some three to ten times faster than through soil it is possible, by analysis of the records, to determine not only the presence of rock but also its approximate horizon. This method of exploration has been highly successful in locating salt domes and other oil bearing structures and in certain mining operations but up to the present time has not been used extensively for shallow determinations such as those involved in building and construction projects.

The seismograph developed by the Bureau of Public Roads was designed especially for shallow work and is capable of measuring the time of travel of a wave through the earth to an accuracy of one two-thousandths part of a second.

Earth-tremor and electrical-resistivity instruments exhibited by the Bureau of Public Roads.

These instruments, the Bureau feels, should have a direct and practical application to the problem of locating sand and gravel deposits as well as to the quarrying of stone. Clean sand and gravel are electrically very resistant compared to weathered top soil, silts, and clays. This property makes it possible to locate large deposits of such material by the resistivity method and thus eliminate the more expensive and laborious method of test pits and core borings.

The quarryman will find both methods of test useful, although the seismograph is perhaps best suited to his particular problem, according to the Bureau. The thickness of the soil covering over solid rock formations can be definitely and accurately determined with the seismograph and even considerable information can be obtained relative to the weathering, seaming, and fractured condition of the rock. The instrument will also determine whether the rock deposit is extensive enough to warrant the development of a quarry.

Utilization of Cotton in Roads Gets U. S. Support

An allocation of $1,300,000 has been approved by the U. S. Dept. of Agriculture to stimulate field tests of new uses of cotton in highway construction. Cotton fabrics for use as a reinforcing membrane in bituminous surface treated highways and for cotton mats for use in curing concrete highways will be furnished upon request to state highway departments so that they may be tested in widespread use under all climatic conditions.

Under the program as approved, cotton fabric for bituminous-surfaced roads will be provided for a maximum of 1,000 mi. of road. About 80,000 cotton mats for curing concrete in highway construction will be made available for an average of at least three projects in each state. The project will be administered jointly by the U. S. Bureau of Public Roads and the Agricultural Adjustment Administration.

Experimental work in the development of cotton mats for curing concrete has shown the mats to be satisfactory and economical for this purpose. Coarse cotton fabric as a reinforcement membrane in bituminous surfaced roads has been tested for a number of years in South Carolina and some experimental projects have been undertaken in other states. It is felt that the only way of determining exactly that the use of the fabric will prove economical is to try it out under widely varying conditions in large amounts.

Makes Inspection Tour of Cement Laboratories

The Cement Reference Laboratory, a joint project of the National Bureau of Standards and the American Society for Testing Materials and sponsored by Committee C-1 on Cement of that society, is now preparing for a fifth inspection tour among cement-testing laboratories.

Those laboratories which desire to avail themselves of this inspection service should address their requests therefor to the Cement Reference Laboratory at the National Bureau of Standards, Washington, D. C. Applications for inspections should be filed promptly since the itineraries for the inspectors will be prepared at an early date. The proposed tour will, in general, provide only one opportunity for the inspection of any laboratory during the next year or two.

France Stone Co. Leases Old Quarry at Weston, O.

★ The France Stone Co. has leased the old Pugh quarry, located near Weston, O., and will start producing material there as soon as equipment can be installed. Pumps are busy at present dewatering the old quarry.

Editorials

Prices and Purchasing Power

NUMEROUS economists have pointed out that even in the days of our greatest prosperity the productive facilities of this country were never fully utilized. An investigation made in a group of leading industries—those producing capital goods as well as those making consumer goods—showed a great range in the degree to which these facilities were employed between industries of low and those of relatively high output-to-capacity ratios. The average for all the groups studied was approximately eighty per cent.

Even high-pressure selling, hypnotic advertising and long-time credit have not created enough demand to use this surplus productive capacity. They have moved millions of dollars worth of capital and consumer goods that would not otherwise have been sold; they have succeeded in placing thousands of labor-saving and other types of cost-cutting and economizing machines in American houses, offices and factories; they have overcome the hesitancy, caution and good judgment of countless private buyers and corporation purchasing agents who had too little need, too little money, or too little desire to buy voluntarily. Yet in spite of all the ingenuity, the coercion and the scheming one-fifth of our production capacity lay idle. Whether we call the difficulty overproduction or underconsumption is immaterial so long as we realize that the inability to employ our factories to the full extent of their capacity is due to the inability of would-be purchasers to buy.

As we have often said before, we have shown great originality in devising new and more efficient productive machinery; our engineers have fulfilled their mission in creditable style. They have provided us with no end of reasonably-priced fair-quality products—and, indeed, a few high-quality products in cases where they were allowed to do so —and they have made available the technique that enables us to produce them in large quantities. Our selling experts have displayed no less originality in developing ways for overcoming the resistance of prospective customers, of making every product seem desirable or necessary, of undermining the buyer's prudence and ordinary sense of proportion. Beyond every other people in the world we have become highly skilled in competing for the consumer's dollar.

But no one seems to have been greatly concerned about whether the consumer has a dollar, or, if he has not, how he can be provided with one. If he is fortunate enough to have but a part of a dollar and a reasonable expectation of getting more, the temporary deficiency can be met by the extension of credit on the theory that he may be able to repay the loan plus the cost (interest). But there is no economic system under which credit can supplant income, under which large numbers of people can continue indefinitely to defer paying for what they buy. The problem is not to provide more credit but to provide more people with incomes of reasonable size and dependability. This means raising the earnings of the lowest income groups, possibly through a rearrangement of the current method of distributing national income.

Among the means for effecting such a redistribution of income is a change in the price policy customary in business. This method necessitates the abandonment of efforts to stabilize, or raise, prices and the adoption of the principle of reducing prices in the expectation that resulting increases in sales will be great enough to make reductions in profits unnecessary. Harold G. Moulton, who favors this method, says that our total national income is not large enough to provide reasonable standards of living for the masses even if it were pooled and divided. Not until the national income exceeds one hundred billion dollars annually—its present size is estimated at sixty-five billions—and approaches two hundred billion dollars "will the goal of a high standard of living for everyone be obtained," according to him.

He is not hopeful that our national income will be raised to any appreciable extent by wage increases for he says that "there is a strong pressure toward the reduction of money wages." No competitive system can "rely upon voluntary increases of money wages as an adequate means of increasing the purchasing power of the masses. Wage increases as a rule are granted only under pressure —exerted by a general scarcity of labor or by the power of labor organizations."

In the price-reduction plan, however, he sees an advantage "in that the benefits are extended automatically to the entire population." These benefits, it should be explained, are not equally important to all groups, since they accrue to the wealthy classes, whose buying capacity is already far in excess of their needs, to an even greater extent than to the wage-earning classes, whose purchasing power is so badly in need of expansion. It might be remarked in passing that a general reduction in prices is likely to be followed by a downward movement of wages, because the same incentive that makes employers resist demands for increased wages, even when these are supported by a shortage of labor or threats of force, leads them to push wages down whenever a falling cost-of-living index seems to indicate a lessening of the pressure for maintaining them.

In theory, and sometimes in practice, a portion of the advantages of the lower production costs

resulting from technological improvements is passed on to the consumer in the form of lower prices, but the share that reaches him in this way does not materially affect the net cost of his living or the size of the unspent savings-surpluses which remain among those consumers who have above-subsistence-level incomes. Reduced prices sometimes increase the costs of competitive selling and tend to restore prices to their fomrer levels; in other cases they may result in the formation of monopolies designed to raise and fix them.

Lower prices benefit those who have money to spend, but they do not improve the condition of the man who is destitute. The continuing large demand for financial relief is sufficient evidence of the fact that the destitution group is still big.

Self-Imposed Production Control

IN THESE days of proposals for production control on a national scale not much is said about the possibilities of control in private establishments except in the direction of increasing operating efficiency and enlarging output. It is interesting as well as unusual, therefore, to learn of a corporation which deliberately, and as the result of a fixed policy, restricts its operations by setting definite limits on the amount of business it will do. The adoption of such a policy requires more than a firm belief in the economic soundness of the plan; it demands an unshakable determination to adhere to methods that appear to be fantastic and to make them succeed in the face of an almost universal custom and of the strong temptation to fall back on what stark individualists would call the "primitive" and "natural" instinct to acquire all one can.

Many students of human habits and numerous philosophers of the arm-chair variety have cautioned us against the "speed that kills," the urge to make things ever bigger and bigger, to do things on an ever-increasing scale of velocity and mass. Physicians warn us of the physical and psychiatrists of the mental hazards of a principle of living that piles one superlative on the top of another and, still unsatisfied, calls for the super-superlative. Actuarians offer unimpeachable data to prove the rapid increase in fatalities due to a high-tension existence whose goals are new records, new "tops," new achievements that serve merely as fresh starting points for new races for the same prizes. In our calmer moments most of us probably realize something of the absurdity and futility of erecting our standards on quantitative rather than qualitative bases.

Irving Salomon, the head of a metal-manufacturing company, recently told how his firm's policy has placed a limit of $1,500,000 on the amount of business it will do in any one year. No attempt is made to crowd production or to push sales in order to show a continually rising curve of dollar volume. Instead, more importance is attached to the desirability of maintaining organization, of stabilizing production, and of leveling the profit curve. In such a scheme there is no place for the fluctuations that are found in even non-seasonal businesses, for the alternating periods of great activity and dullness, of extra help and unemployment.

This business man, who is anything but a theorist of the academic type, emphasizes the value of work that progresses at an even rate, that imposes no nervous-tension load on workers and therefore leaves them time and opportunity in which to consider its psychic satisfactions, that banishes much of the boredom of repetitive operations and encourages that greater proficiency which raises the quality of the output. Eliminating high-pressure methods from the company's aims has resulted, naturally, in eliminating high-pressure tactics from its selling, and — we might add as our own opinion only—has undoubtedly destroyed much of the basis for unfair competition and discriminatory treatment of customers. The company has won a reputation for quality and is the beneficiary of a growing good-will because of the fact that it is not fighting for business but is, indeed, in a position to refuse orders and refer buyers to other manufacturers. We imagine that nothing could more rapidly build a reputation for producing a good product than the discovery by prospective buyers that they must plan their purchases in advance because of the high buyer-acceptance of what they want to buy.

The company's advertising—the firm really continues to advertise despite the success of its good-will-building policy—is naturally of the institutional type, since there would be no reason in trying to stimulate sales when the firm's objective is not to strive for continuous expansion. It aims to increase the company's reputation and thus aids in the officials' efforts to stabilize what would otherwise be a "normal" ups-and-downs business.

Needless to say, there is no tendency to discriminate between buyers when there is no desire to force sales, no need to attempt to create a monopoly when there is no wish to control markets and fix prices, no necessity for crushing competitors when there is no greed to acquire their customers. The losses in labor turnover must be small when employment is so steady; poor workmanship and imperfect product can not be a serious factor when workers are led to like and take a pride in their work by the feeling of security that regular employment gives them; there must be little restlessness in an organization that is not being constantly prodded to produce superhuman results; and there must be considerable satisfaction in knowing that there is no need to force their product on hesitant and unwilling buyers.

Such a business, we might add, must by these methods be well insured against the terrors and losses of major economic disturbances. Where is the business man who would not give much to reduce the uncertainties of his business by eliminating the fluctuations in his sales and production curves?

Truck-loading bins, trestle and mine entrance, Silica Co. of California, Ltd.

HIGH COST OF PROCESSING AT THIS SILICA PLANT JUSTIFIED

By
W. E. TRAUFFER

A PLANT near Brentwood, Cal., operated by the Silica Co. of California, Ltd. for the production of various grades of silica sand, involves some processes not ordinarily found in this industry. Because of the rarity of sand suitable for the manufacture of clear glass within economical shipping distance of glass plants in this territory, this company finds it profitable to process material at an expense which would probably be prohibitive in any other part of the country. The material in this deposit has a coating of iron which is removed by dissolving in chemicals. The iron content (Fe_2O_3) in the raw material is .25 per cent. and this is reduced to .04 per cent. in the finished flint sand, which is accepted by glass companies for the manufacture of clear glass. Amber sand for colored-bottle manufacture and several grades of casting sand produced are not chemically treated.

Development of this property, which is about 50 mi. east of San Francisco and 25 mi. west of Stockton, Cal., was begun in 1929 by a group of promoters who lacked the funds to carry through the project. In 1930 the present owners took over the deposit and in November of that year put into operation a pilot plant with a capacity of 40 tons per day. After proving this product to be suitable for clear-glass manufacture construction of the present plant was begun. This went into operation early in 1931 with a capacity of 400 tons daily. In 1933 a complete new dry-screening section, with a capacity of 40 tons per hr., was added. This addition included three 200-ton steel bins, three bucket-elevators, and two vibrating screens. A new wet-grinding mill was also added. In 1934 a vibrating conveyor was installed in the drying department. In September, 1935, a new dry-grinding mill and a Rotoclone were added.

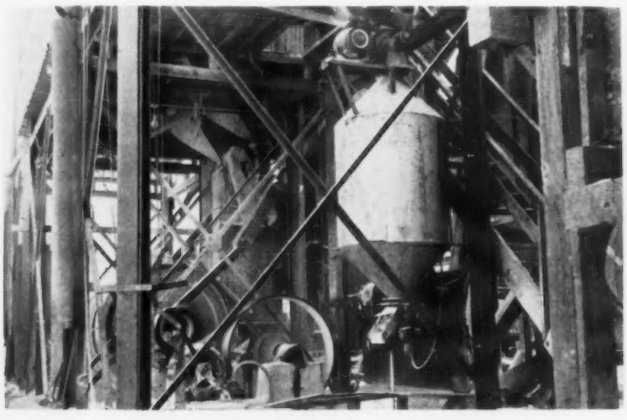
The plant in its present form represents a total investment of about $200,000. It has an annual production of about 75,000 tons of glass sand and 10,000 tons of steel-casting sand. Most of the product is marketed in the San Francisco Bay area, although some is shipped as far as Los Angeles. Some casting sand is also shipped to Mexico, the Philippines and Hawaii.

The deposit, which is in the foothills of the Diablo Mountains 3 mi. west of the plant, consists of a stratum 30 to 40 ft. thick which declines from

A view of the silica-sand plant with main storage bins at the right.

an outcrop at a slope of 30 deg. The deposit is tapped by a timbered tunnel at the base of a hill which parallels the strike to a present depth of about 2,000 ft. The room-and-pillar system of mining is employed and allows about 70 per cent. of the material to be reclaimed to the full depth of the deposit. All stopes opened to this date have been worked up-slope to the surface. Later stopes will probably be opened down-slope.

Drilling is done with 110-v. Van Dorn electric auger drills, and No. 6 Hercomite is used for blasting. A ½-cu.yd. drag-scraper, operated by a 7½-hp. electric hoist, hauls the blasted material to chutes through which 1½-cu.yd. Joshua Hendy side-dump cars are loaded. Cars are hauled from the mine by an 8-ton Jeffrey electric trolley locomotive. The material is dumped from a trestle into timber bunkers



View in the new dry plant with pebble-mill at left, dust-collector and storage tank for silica-flour production at right.

having a total capacity of 350 tons. Trucks are loaded from the bins through a 4-in. grizzly. As the mine is above the water table no artificial drainage is necessary. The stope openings, combined with the strong prevailing winds, provide ample ventilation except immediately after a blast, when blowers are used.

At the plant the trucks are run on a ramp and their contents discharged into a 75-ton surge hopper. A Traylor vibrating feeder of 100-ton-per-hr. capacity feeds the material from this hopper to a 50-ft. belt-bucket-elevator. This discharges it on a Straub combination 1-in. grizzly and roll crusher which reduces the material to grain size, of which about 15 per cent. is coarser than 30-mesh. The fines from the grizzly and roll are combined and fed to a Straub 4-ft. by 5-ft. revolving screen having 8-mesh wire cloth. The oversize from this screen, mainly clay, is flumed to waste.

The minus 8-mesh material from the scalping screen goes through a split chute to two Straub 4-ft. by 5-ft. revolving screens having 20-mesh wire cloth. Ludlow-Saylor phosphor-bronze wire cloth is used on all these screens, which are equipped with sprays. Coarse material (minus 8- to plus 20-mesh) from these two screens can be chuted to a bin for No. 3 foundry sand which is shipped out direct. Ordinarily the oversize from these screens goes to a 4-ft. by 3-ft. Straub ball-mill, which is lined with

The 5-ft. cone used to dewater steel-casting sand before it is stored in bins.

manganese-steel plates and loaded with steel balls.

The minus 20-mesh product of this mill is forced by two 3-in. Hydroseal pumps to a pair of 16-ft. Dorr Duplex rake classifiers, to which the minus 20-mesh from the revolving screens goes direct. Revolving splitters feed the product of the classifiers to nine Straub Overstrom 6-ft. by 16-ft. concentrating tables, which are lined with linoleum and have oak riffles. The various heavy mineral impurities, such as zircon, tourmaline, ilmenite, etc., are removed here. The tailings flow to a 2-in. Kimball-Krogh sand pump which forces them to two Dorr tray thickeners equipped with revolving rakes. Waste from the screws to be described later is also

Direct-fired rotary drier with vibrating conveyor below and elevator at right.

flumed to these thickeners. A small diaphragm pump then sends the material to a dewatering screw, from which the dewatered tailings are removed and used to build up levees for the settling ponds. Waste water from the thickeners and screw flows to these ponds, which have a combined capacity of 20 acre-ft.

The concentrating tables produce three grades of usable materials. The No. 2 steel-casting sand

(minus 20- to plus 80-mesh) flows into a 2-in. Wilfley pump which discharges it into a 5-ft. Allen dewatering cone. The dewatered product drops into a bin from which it is loaded out for shipment.

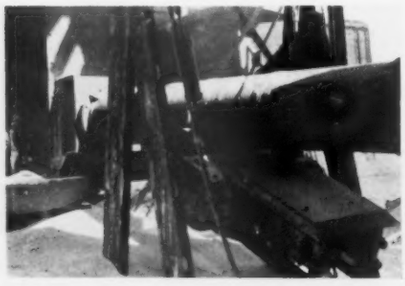
The other two products of the concentrating tables—amber sand (minus 30 to plus 150-mesh) and flint sand—flow into sumps from which two Wilfley sand pumps, one 2-in. and one 3-in., remove them to storage. The pump lines discharge respectively to two 30-in. and one 36-in. Straub dewatering screws. These are mounted on rails so that they can discharge as desired to any of the four 250-ton and six 125-ton timber drainage bins. The pipe-lines feeding the screws are tapped at various points with rubber hoses which feed the screws. Screw clamps are used to shut off the hose connections when not in use in a manner similar to that used in chemical laboratories as metal valves did not work satisfactorily due to the abrasiveness of the material. The overflow from these screws goes by flume to the Dorr thickeners previously described.

Amber sand is recovered from the drainage bins by Straub-Challenge feeders, which discharge on a 180-ft. belt-conveyor. A 30-ft. belt-bucket-elevator feeds the sand to a 5-ft. by 40-ft. Geiger direct-fired rotary drier. Natural gas used in this drier is obtained from the pipe-line which connects the San Francisco Bay region with the Kettleman Hills oil fields 300 mi. from the plant. The dried sand is discharged on a Traylor tubular electric vibrating conveyor 45 ft. long. This carries it up a 5-deg. slope to a 60-ft. chain-bucket-elevator which discharges it into one of three 200-ton, 2-compartment steel bins each 15 ft. in diameter. A cyclone and fan reclaim the dust from the drier.

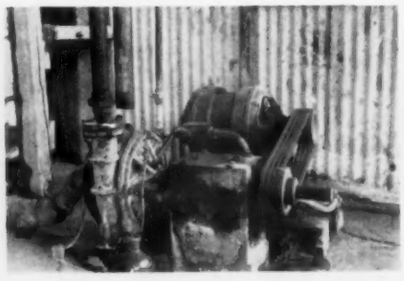
Amber sand is fed from this bin to two 4-ft. by 8-ft. Robins Vibrex single-deck screens having 30-mesh wire cloth. The oversize is chuted to a 5-ft. by 10-ft. Straub pebble mill which is Silex-lined and loaded with imported Danish pebbles. This mill is fed at both ends and discharges through two grates at a single discharge point. It has a capacity of 5 tons per hr. under present conditions. A short bucket-elevator feeds the sand to one half of a 60-ft. double belt-bucket-elevator which returns the mill product to the screens in closed circuit. The undersize (minus 30-mesh) from the screens is fed to the other half of the double elevator and is discharged to another of the three bins. From this bin the amber sand is loaded by means of a Stephens-Adamson Sinden loader, into lined box-cars for shipment. An American Air Filter Co. Roto-Clone connected to these screens and the dry-grinding mill settles out the silica flour at a temperature of 250 deg. F.

When flint sand is being processed, it follows the same flow from the bins and through the drier. The dried material, however, is discharged into a 25-ft. Geiger screw-conveyor feeding a 50-ft. bucket-elevator, which empties it into two lead-lined leaching tanks where the sand undergoes chemical treatment for the removal of iron. The special catalyst used in solution is stored in two adjoining tanks. When this batch-treating process is completed, the solution is washed out of the sand with water. The pure flint sand is then dewatered in a 5-ft. by 20-ft. drag-box and discharged by a belt-conveyor into 12 timber drainage and storage bins having a capacity of 100 tons each. A feeder reclaims the sand from the bins to a belt-conveyor which again takes this material to the rotary drier. The pure dried flint sand is then carried by the same Traylor vibrating conveyor and 60-ft. elevator previously mentioned to the third 15-ft.-diameter steel bin from which it is loaded into cars.

(*Continued on page 56*)



Vibrating conveyor which carries dry material to bucket elevator at left.



Pumping unit which forces product of raw-grinding mill to classifiers.

One of the pumps used to carry material from concentrating tables to storage.

Trolley locomotive hauling dump cars from mine to the truck-loading bins.

Gen. Mgr. K. G. Schwegler, Foreman Geo. Snoreen, Auditor Chas. Eckland, and Gen. Supt. J. Krill.

THE ECONOMICS OF READY-MIX VERSUS JOB-MIX CONCRETE*

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ECONOMICS, strictly speaking, is a science of the laws of production and distribution of wealth, including all the causes of prosperity and its opposite. For the purpose of this paper, the application of this broad science to the problem at hand is narrowed down to the consideration of the relative financial advantages accruing to a contractor in fulfilling an obligation to furnish a concrete structure by either:

(1) Purchasing the concrete delivered at the site, ready for use, designated as ready-mixed concrete, or

(2) Purchasing the raw materials processed more or less and fabricating concrete at the site, designated as job-mixed concrete.

The multiplicity of factors affecting the cost of producing concrete is such that it is impossible to give the monetary data except for specific cases. This paper, therefore, is presented merely as a guide to assist the contractor in selecting the most advantageous method of supplying his job with concrete of required quality.

Ready-mixed concrete, also designated as premixed concrete, is defined in the A. S. T. M. Specifications for Ready-Mixed Concrete (C94-35) as mixed concrete delivered at the work ready to use.

Ready-mixed concrete is produced by one of two methods:

(a) Centrally-mixed concrete or central-plant-mixed concrete, where the concrete ingredients are proportioned and mixed in a central plant and then hauled to the job in trucks generally provided with agitators.

(b) Truck-mixed concrete or central-plant-proportioned truck-mixed concrete, where the concrete ingredients are proportioned at a central plant and mixed in the conveying trucks while in transit to the job or after arrival. In this case the necessary water is carried separately in a measuring tank and added when the mixing operation is started.

The sale of ready-mixed concrete has in the last fifteen years become an important industry, particularly in large centers where there is a demand for this commodity.

Many of the ready-mixed-concrete manufacturers are members of the National Ready Mixed Concrete Assn. with headquarters in Washington, the purpose of which is to promote the use of their product and disseminate accurate information concerning its preparation and use. The engineering division of the association publishes from time to time bulletins designed to furnish information of interest to the users and producers of ready-mixed concrete.

During the period of development of this industry, the mechanical means of producing and transporting concrete have been vastly improved and the great majority of plants are now equipped to furnish concrete meeting the most rigid specifications.

The facilities for accurately proportioning the batches, controlling the grading of the aggregates, their moisture content, the water-cement ratio, etc., are far more efficient than found on the average job.

This factory-made concrete, therefore, may be expected to possess more uniform characteristics than job-mixed concrete, which may result in better concrete structures if this uniformity of the original product is not vitiated through segregation resulting from improper handling and placing.

While ready-mixed concrete is generally regarded as a product purchased from one engaged in its manufacture solely for profit, there are cases where contractors have set up central mixing or proportioning plants of their own, used purely to supply one or more of their operations.

The purchase of fresh concrete must be based on specific requirements from the standpoint of quality and measurement from the standpoint of equity to both the purchaser and seller.

The quality of fresh concrete may be specified in a number of ways:

(1) By arbitrary proportions;
(2) By cement-content per cubic yard;
(3) By water-cement ratio;
(4) By compressive resistance at a given age.

Apart from the characteristics fresh concrete must possess in order to produce set concrete of the requisite quality, it must be of such a consistency or fluidity when delivered that it can be placed at a reasonable cost.

The degree of fluidity is not necessarily a fixed index. For instance, in concreting structures composed of a variety of small members crowded with reinforcing bars, thin and high columns of walls, and large slabs, it is often desirable to alter the consistency of the concrete to insure proper compaction and uniformity throughout the work. In

*Report of Committee 610 of the American Concrete Institute, presented at the thirty-second annual convention, Chicago, Feb. 25-27, 1936.

high "pours" it is desirable to alter the mix slightly to eliminate the accumulation of fines at the top of each "pour." Such corrections are difficult if not impossible to make where the control of the mix is remote from the site. It has been observed that, furthermore, the consistency or fluidity of concrete changes with the time of mixing. Long mixing periods tend to stiffen the mass, due in part to a grinding action which tends to increase the percentage of fine materials in the mix and perhaps the absorption of an increasing amount of water by the aggregate and the cement.

Ready-mixed concrete can not readily be altered once received. Transit-mixed concrete, on the other hand, can be corrected at the job since the transporting equipment is, in reality, a mixer. The only remedy, however, is through the addition of water, which under some specifications may vitiate the acceptability of the concrete.

In considering ready-mixed concrete for a job the purchaser should satisfy himself that the dealer is equipped to supply the job at the maximum required rate without interruption. This is of particular importance as delays in delivery involve serious loss of time on the part of the gangs placing the concrete.

In localities where heavy traffic is encountered between the central plant and the job resulting irregularities in delivery may be obviated by having an ample number of trucks in transit or providing a reservoir on the job of sufficient capacity to smooth out the gaps between trucks.

There is, however, a disadvantage in this procedure in case of a sudden stoppage in the concreting process on the job due to unforeseen causes, in so far as the concrete in the trucks in transit or in the reserve bin on the job may have to be wasted and may be charged against the purchaser in case the seller is unable to divert the trucks to some other job.

Transit-mixed concrete does not offer the same disadvantage since the mixing operation can be delayed a much longer time, governed largely by the moisture content of the aggregate which, if present in sufficient quantity, may spoil the cement.

Where ready-mixed concrete is used on a job, a more careful scheduling of "pours" is necessary than is the case with job-mixed concrete and close coördination between the plant and the job during the period of delivery is necessary to minimize the disadvantages described above. In comparing the costs of job-mixed and ready-mixed concrete the purchaser must weigh these factors and allow for them lest he be faced with indirect costs which well may upset his direct cost comparison.

In determining the quantity of concrete delivered some easy method of measuring the mass must be established, either directly or by summing up the absolute volumes of the ingredients in a batch.

The verification of quality and quantity involves a considerable amount of testing and supervision which is not within the province of this paper, except in so far as it affects the cost of ready-mixed concrete to the user. In some cases this supervision is conducted by the users' own concrete technicians. If not available, the services of a testing laboratory may be secured to verify the quality and quantity of the concrete delivered, much as is done in the case of structural steel.

The Tentative Specifications for Ready-Mixed Concrete of the American Concrete Institute (504-31T, the A. S. T. M. Specifications (C94-35), and the literature of the National Ready-Mixed Concrete Assn., all contain information valuable to the prospective purchaser of ready-mixed concrete.

For the purpose of comparing the cost of ready-mixed concrete with that of job-mixed concrete it is essential that all costs direct or indirect engendered by the process of combining the ingredients into concrete on the job be established and assembled into a cubic-yard unit. Such an analysis involves many factors which are dependent on the nature and magnitude of the job, the costs of raw materials, plant installation, rentals and dismantling, insurance, supervision, etc. While most contractors are fully capable of establishing such costs, it is believed of interest to discuss this phase of the problem.

The various methods of concrete making on the job are:

(a) Receiving the materials in trucks as required, storing the cement on platforms, protected by canvas, and the aggregate in piles from which wheel-barrows are filled manually and wheeled to a mixing platform or a power mixer.

This method, the most economical from the standpoint of plant, is used where the rate of concrete supply is small and the total quantity of concrete is too small to absorb economically the cost of more extensive plant equipment. This method is inadequate where accurate control of the concrete proportions is required.

(b) The materials are received in trucks or cars, the cement stored in cement sheds and the bulk aggregate in bins directly from the trucks or conveyors, the cement being fed from the storage shed to the mixer by wheel-barrows or conveyors and the aggregate directly from the bins into measuring equipment of the volumetric, weight or inundation type.

This type of plant is applicable to almost any concrete job of sufficient size to absorb the cost of the plant; in other words, where the labor saved in the handling of the materials is sufficient to offset the cost of the plant and operation. With this type of plant concrete capable of meeting the most rigid specification can be produced.

In very large operations, suitably located, the cement may be received in bulk, stored in specially constructed bins which are charged by means of cement pumps and fed to the mixer in the correct amount by means of weighing equipment.

In some localities the fine and coarse aggregate may be purchased in properly proportioned batches which are dumped from trucks directly into the mixer hopper as required.

This method of delivery eliminates the plant charges and labor involved in the storing, handling and measuring of the aggregate on the job. In cer-

tain cases the cement in correct quantity is added to each batch on the truck, thus further reducing the plant and labor charges on the job.

In analyzing the job the well-informed contractor will select the method which yields the most economical production of concrete consistent with the requirements of the job and the specifications.

The cost thus obtained furnishes the basis of comparison between that of job-mixed concrete and the price quoted for ready-mixed concrete by the dealers.

Where the use of plant is involved in these calculations, there may be a considerable difference of opinion between the contractors as to the value chargeable to the job. Many indirect expenditures are frequently overlooked with the result that the cost of concrete per yard, based thereon, may be fictitious. With ready-mixed concrete, purchased at so much per yard, the elements of uncertainty are assumed by the dealer and the contractor knows exactly what his concrete will cost him, except that this price may be modified by excessive labor costs on the job due to unsatisfactory delivery or loss of concrete as pointed out elsewhere in this paper.

The total cost of job-mixed concrete is made up of the following items:

1. PLANT—
   (a) Transportation to and from the job.
   (b) Installation and dismantling.
   (c) Rental.
   (d) Operation.
2. MATERIALS—
   (a) Cost of raw materials.
   (b) Labor cost of receiving and storing.
   (c) Handling cost, including measuring and mixing.
   (d) Loss due to bulking of aggregate.
3. INCIDENTALS—
   (a) Supervision.
   (b) Testing.
   (c) Insurance.
   (d) Accounting.

The total cost of ready-mixed concrete is made up of the following items:

1. PLANT (for receiving concrete)—
   (a) Transportation to and from the job.
   (b) Installation and dismantling.
   (c) Rental.
   (d) Operation.
2. CONCRETE—
   (a) Cost of concrete.
   (b) Labor cost of receiving.
   (c) Loss due to waste.
   (d) Loss due to shortage of quantities received.
3. INCIDENTALS—
   (a) Supervision.
   (b) Testing.
   (c) Insurance.
   (d) Accounting.

Table I is a list of plant items which a contractor must price according to the local conditions, selecting from the list such items as are required for the type of plant he chooses to use for a particular job.

It is recognized that certain cost items, such as fuel or power, supervision, operators, etc., are difficult to isolate from the rest of the job-plant cost, but the value of these items compared to the total cost is small and can be approximated without much error.

Where the nature of the job is such that the ready-mixed concrete can be discharged directly from the trucks into the forms, the equipment or plant required to distribute job-mixed concrete may be saved. On jobs where space is not available for the storing of concrete materials or erecting a mixing plant ready-mixed concrete is, of course, the only alternative.

Table I — JOB PLANT

	Material	Transportation to and From Job	Erection	Rental	Dismantling
CEMENT					
Storage at Site					
(a) Platform and canvas					
(b) Shed					
(c) Tank and pump					
Handling Equipment					
(a) Conveyors					
(b) Bag-bundling machine					
Measuring Equipment					
(a) Weighing machine					
AGGREGATE					
Storage at Site					
(a) Platforms					
(b) Bins					
Handling Equipment					
(a) Conveyors					
(b) Derricks					
(c) Carryalls					
Measuring Equipment					
(a) Volume batchers					
(b) Weighing batchers					
(c) Inundators					
Heating Equipment					
(a) Steam coils					
WATER					
Conveying and Storage					
(a) Piping or hose					
(b) Pump					
(c) Tank					
Measuring Equipment					
(a) Volumetric tank					
Heating Equipment					
(a) Steam jet or coils					
MIXING					
(a) Platforms for Hand Mixing					
(b) Power Mixers					
POWER EQUIPMENT TO OPERATE THE ABOVE-LISTED MACHINERY					
(a) Electric Motors					
(b) Gasoline Engines					
(c) Steam Engines					
(d) Boilers					
(e) Wiring					

In some cases contractors have found it more advantageous from the standpoint of cost to construct their own central-mixing plant and feed one or more jobs from it than to purchase ready-mixed concrete from a dealer whose plant may be too far away from the job or whose sale prices may be too high to compete with the cost to the contractor of manufacturing and transporting the concrete he requires.

Aside from the true difference in costs between job-mixed and ready-mixed concrete a contractor may purchase more expensive ready-mixed concrete from a dealer because it reduces the initial outlay of money for plant equipment and the credit extended him reduces his weekly pay-roll, thus reducing the amount of cash necessary to carry on his contracts.

On jobs of the type of a multi-story reinforced-concrete building it has sometimes been found economical to purchase ready-mixed concrete for the installation of the foundations, when small daily quantities of concrete are required and the erection

(*Continued on page 59*)

A. R. E. A. REVISES GRAVEL-BALLAST SPECIFICATIONS

At the annual meeting of the American Railway Engineering Assn., held in Chicago on March 10 to 12, 1936, revised specifications for prepared and pit-run gravel ballast were approved for incorporation in the forthcoming *Manual*—a compendium of recommended practice for railway engineers. While there is no definite obligation on the part of the individual railroads to use A. R. E. A. specifications, they are quite generally adopted, and, in any event, they furnish a pattern for the requirements of the several railroads.

It should be pointed out that these gradings as revised have been incorporated in the group of standard sizes, applicable to crushed stone and slag as well as sand and gravel, recommended jointly by the National Crushed Stone Assn., the National Slag Assn., and the National Sand and Gravel Assn., which are being used as a basis for the simplified practice program being carried out in coöperation with the Division of Simplified Practice of the National Bureau of Standards. (See PIT AND QUARRY, December, 1935, pp. 39-40.) The Division of Simplified Practice has distributed those recommended standard sizes, which include sizes for all common uses of mineral aggregates in the construction field, to the several railroads.

The specifications follow:

SPECIFICATIONS FOR PREPARED GRAVEL BALLAST

Adopted by American Railway Engineering Assn., March, 1936

1. *General Characteristics.*—Prepared gravel for ballast shall be composed of hard, strong and durable particles of crushed or uncrushed gravel free from injurious amounts of soft and friable particles and other deleterious substances, and shall conform to the requirements set forth in this specification.

2. *Grading.*—Prepared gravel for ballast shall be graded from fine to coarse within one of the sets of limitations in the following table, depending upon the percentage of crushed particles:

Size of Square-Opening Sieve	Amount Passing Each Size (*per cent.*)					
	0 to 20% Crushed		21 to 40% Crushed		41 to 100% Crushed	
	Max.	Min.	Max.	Min.	Max.	Min.
1 ½-in.	.....	100	.....	100	.....	100
1-in.	100	80	100	65	95	60
½-in.	80	50	75	35	50	25
No. 4	40	20	35	10	15	0
No. 8	35	15	10	0	5	0
No. 16	25	5	5	0	.....	.....
No. 50	10	0	.....	.....	.....	.....
No. 100	2	0	.....	.....	.....	.....

Note.—The sieves shall conform to accepted standards for laboratory sieves; sieves of 4-mesh and finer shall conform to the Standard Specifications for Sieves for Testing Purposes (A.S.T.M. Designation: E 11) of the American Society for Testing Materials; sieves coarser than 4-mesh shall conform to the requirements outlined in Standard Method of Test for Sieve Analysis of Aggregates for Concrete (A.S.T.M. Designation: C 41) of the American Society for Testing Materials, or to requirements subsequently promulgated by either the American Society for Testing Materials or the American Standards Assn.

3. *Deleterious Substances.*—Prepared gravel for ballast shall not contain deleterious substances in excess of the following amounts:

Material finer than 200-mesh sieve.....1.0 per cent.
Soft and friable particles.....5.0 per cent.
Clay lumps .....0.5 per cent.

4. *Soundness and Resistance to Abrasion.*—(a) Prepared gravel ballast shall be considered to have met the requirements for soundness and resistance to abrasion when satisfactory evidence is available showing that the material has proved satisfactory in service under conditions essentially the same as those for the use for which it is proposed.

(b) Prepared gravel ballast failing to meet the requirements given in Sec. 4 (a) shall be subjected to the sodium-sulphate soundness test and modified Deval abrasion test, and shall meet the following requirements:

Loss in sodium-sulphate test, not more than —— per cent.[1]
Percentage of wear, not more than:
Rounded gravel ..... —— per cent.[2]
Crushed gravel ..... —— per cent.[2]
Mixtures of rounded and crushed gravel —— per cent.[2]

5. *Test Methods.*—All tests shall be carried out in accordance with the following methods:

(a) *Sampling.*—One representative sample shall be taken for each ton of aggregate delivered unless otherwise ordered by the engineer. Samples shall weigh not less than 50 lb.

(b) *Sieve Analysis.*—The sieve analysis shall be made in accordance with the Standard Method of Test for Sieve Analysis of Aggregates for Concrete (A.S.T.M. Designation: C 41) of the American Society for Testing Materials.

(c) *Material Finer than 200-Mesh Sieve.*—The percentage of dust, dirt, loam, and other fine material shall be determined in accordance with the Tentative Method of Test for Determination of Amount of Material Finer Than No. 200 Sieve in Aggregates (A.S.T.M. Designation: C 117-35T) of the American Society for Testing Materials.

(d) *Soft and Friable Particles.*—The percentage of soft and friable particles shall be determined in accordance with the Standard Method of Test for Quantity of Soft Pebbles in Gravel (Method T-8) of the American Assn. of State Highway Officials.

(e) *Clay Lumps.*—The percentage of clay lumps shall be determined by examining the various fractions which remain after the sieve analysis. Any particles that can be broken up with the fingers shall be classified as clay lumps and the total percentage of all clay lumps shall be computed on the basis of the total original weight of the sample used in the grading test.

(f) *Soundness.*—When the accelerated soundness test is required it shall be made in accordance with the Tentative Method of Test for Soundness of Coarse Aggregate by Use of Sodium Sulphate or Magnesium Sulphate (A.S.T.M. Designation: C 89-35T) of the American Society for Testing Materials or subsequent revisions thereto.

(g) *Percentage of Wear.*—When the percentage of wear is required it shall be determined in accordance with the

[1] A limit of 15 per cent. is commonly specified for concrete aggregates using the present test method; revisions in the test method being discussed will, if adopted, require a modification in specification limits; the engineer should insert a limit in the specification consistent with local conditions.

[2] Limits frequently specified are 15 per cent. for rounded gravel and 25 per cent. for gravel consisting entirely of crushed particles; the limiting percentage of wear for mixtures of crushed and uncrushed gravel should be computed as outlined in the test method; the engineer should insert limits in the specification consistent with local conditions.

Tentative Method of Test for Abrasion of Gravel (A.S.T.M. Designation: D 289-28T) of the American Society for Testing Materials, except that the sample shall be prepared on the designated sieves with square openings instead of round openings.

(h) *Percentage of Crushed Particles.*—The percentage of crushed particles in prepared gravel ballast shall be determined on a representative sample, weighing not less than 10 lb., of the material coarser than the No. 4 sieve. Particles having one or more faces resulting from fracture shall be considered as crushed particles. The percentage by weight of crushed particles in the material coarser than the No. 4 sieve shall be considered as the percentage of crushed particles in the sample.

6. *Inspection.*—In case inspection and tests show that the material which has been or is being loaded is not in accordance with these specifications, the inspector shall notify the contractor to require that further loading be stopped until the fault has been corrected, and to dispose of all defective material that has been loaded in cars, which shall be done without cost to the railroad.

7. *Measurements.*—(a) When ballast is being paid for by the ton, and it is impracticable to weigh each car, the weight per cubic yard shall be obtained by weighing at frequent intervals not less than five cars loaded with ballast, the contents of which have been carefully measured. The weight per cubic yard obtained by such a test shall be used in figuring the weight per car until another test is made.

(b) When ballast is paid for by the cubic yard, the amount shall be determined by weighing each car, where practicable, and applying the weight per cubic yard as determined by frequent tests. When impracticable to weigh each car, the contents of each car will be carefully estimated by comparison with cars the contents of which have been actually measured.

SPECIFICATIONS FOR PIT-RUN GRAVEL BALLAST

Adopted by American Railway Engineering Assn., March, 1936

1. Pit-run gravel, to be suitable for ballast, shall meet the requirements for Grade A or Grade B given in these specifications.

2. Pit-run gravel for ballast shall be classified as Grade A or Grade B in accordance with the following limitations.

Size of Square-Opening Sieve	Amounts Finer Than Each Size (*per cent. by weight*)	
	Grade A	Grade B
2½-In.	97 to 100	97 to 100
No. 4	20 to 55	20 to 65
No. 200	0 to 2	0 to 3

Methods of Testing Quality of Pit-Run Gravel for Ballast.

1. The size of the sample to be tested shall be approximately 1 cu. ft.

2. Five average samples of about 1 cu.ft. each shall be selected from various parts of the pit which is to be tested. The five samples shall be thoroughly mixed and about 1 cu.ft. of the mixture selected for testing.

3. Sieves used for testing shall comply with Standard Specifications for Sieves for Testing Purposes (A.S.T.M. Designation: E 11-26).

4. The percentage of material finer than the No. 4 sieve shall be determined on a sample weighing not less than 50 lb. which has been dried before test. The result shall be expressed as a percentage by weight of the total sample.

5. The percentage of material finer than the No. 200 sieve shall be determined in accordance with the Tentative Method of Test for Determination of Amount of Material Finer than No. 200 Sieve in Aggregates (A.S.T.M. Designation: C 117-35T).

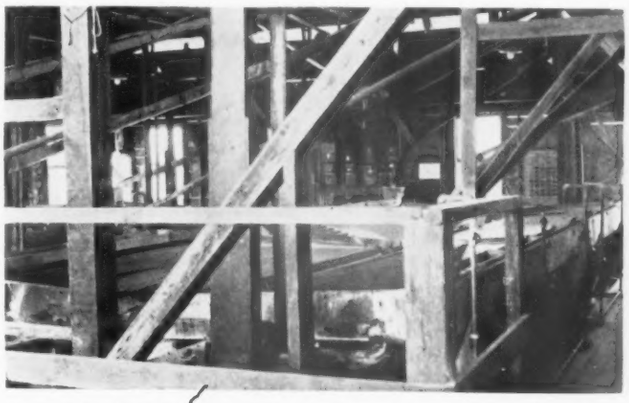
6. When the sample is shipped for test it shall be carefully and securely marked with the name and location of the pit from which it was taken.

Silica Plant

(from page 54)

A Cletrac 20 tractor is used for "spotting" and pulling cars, for building up the settling-pond dikes, and for other miscellaneous purposes about the plant. Byron Jackson water pumps supply wash water to the plant from these ponds. There is a complete laboratory where each batch of flint sand is analyzed before it is shipped.

Westinghouse electric motors and gearmotors are used almost exclusively in this plant. V-belts are



Nine 6-ft. by 16-ft. concentrating tables remove impurities from the sand.

used on some of the equipment, Dayton Cog-Belt on the Wilfley sand pumps, the acid pumps, the Hydroseal pumps and the Rotoclone, and Allis-Chalmers Texrope on the two grinding mills. Most of the other equipment is driven by Link-Belt roller chains. The Link-Belt Co. also furnished the bucket-elevators, conveyor idlers and pulleys, etc. Pioneer conveyor belting is used throughout.

The main office of the Silica Co. of Cal., Ltd., is at 405 Montgomery St., San Francisco, Cal. The officers are: Stanley Pedder, president; K. G. Schwegler, vice-president and general manager; R. D. Carmiencke, secretary; Charles Eckland, treasurer. J. Krill, a chemical engineer, is general superintendent.

Ready-Mix vs. Job-Mix

(from page 57)

of the main mixing plant would interfere with the progress of the job at that stage. After the floors and roof have been placed from a job-mixing plant the contractor resorts again to the use of ready-mixed concrete for the pouring of odds and ends, such as stairs, pent houses, concrete sills, etc., which generally proceed at a slow rate with the other trades and at which time the main plant would interfere with the finishing trades.

As stated at the beginning of this paper, it is impossible to give specific costs of either ready-mixed or job-mixed concrete. The costs published in the *Engineering News Record* indicate a range from $5.45 to $8.25 per cu.yd. for ready-mixed concrete between different parts of the country. The range in cost of job-mixed concrete for the great variety of job conditions, labor rates, material costs, etc., for different parts of the country, far exceeds that given for ready-mixed concrete. . . .

RECLAIMING MANGANESE EQUIPMENT WITH NICKEL-MANGANESE STEEL

● By B. H. PAYNE

General Manager,
Stulz-Sickles Co.
Newark, N. J.

Cracked manganese-steel bucket repaired by the use of nickel-manganese bare welding electrodes.

MANGANESE steel as we know it to-day was discovered by Robert A. Hadfield in the steel works of his father in Sheffield, England, in 1882. Mr. Hadfield was attempting to develop a steel that would possess both hardness and toughness. This is a difficult combination inasmuch as hardness usually implies brittleness and toughness is usually softness in ordinary steel.

No steel at that time had been discovered that combined the two. Prior to Hadfield's work practically nothing had been done with the little-known metal, manganese, in fact, little was known about alloys. At that time about the only one was a self-hardening tool steel which was being produced and marketed in a limited sort of way. About all that was known of manganese was that it was beneficial to steel in small amounts. All efforts to introduce into steel 3 or 4 per cent. of manganese resulted in the ductility of the steel being reduced and brittleness set up and only a worthless product developed. It was due to Hadfield's persistence in continuing to add manganese in larger percentages that resulted in what is known as Hadfield 11- to 14-per cent. manganese steel.

Hadfield's work was not limited to analysis but covered a heat treatment of the steel. Hadfield standard manganese steel contains from 10 to 14 per cent. of manganese and from 1 to 1.40 per cent. of carbon. Due to its comparatively high carbon content the micro structure of the steel, before heat treatment, consists of austenite plus a considerable amount of free carbide or cementite. The carbide is hard or brittle and its presence breaks up the continuity of the austenite and results in a very brittle metal. In order to dissolve the carbide in the austenite, manganese steel is heated to a temperature between 1,830 to 1,900 deg. F. and quenched in cold water. The heating dissolves the carbide in the austenite by placing it in solution and the quick quenching keeps it in solution. The result is a very tough metal, having a high coëfficient of thermal expansion approximately 1½ times that of iron and a very low heat conductivity. There is a great difference in the cooling rates of the interior and the exterior of a manganese-steel casting and it is this difference that very often causes internal stresses, and cracks are set up inside a casting and work out toward the surface when in service. By the reheating of heated and toughened 11- to 14-per cent. manganese steel for several hours, even at low temperatures, the carbide held in suspension is liberated and distributed throughout the austenitic structure, which results in the steel becoming exceedingly brittle.

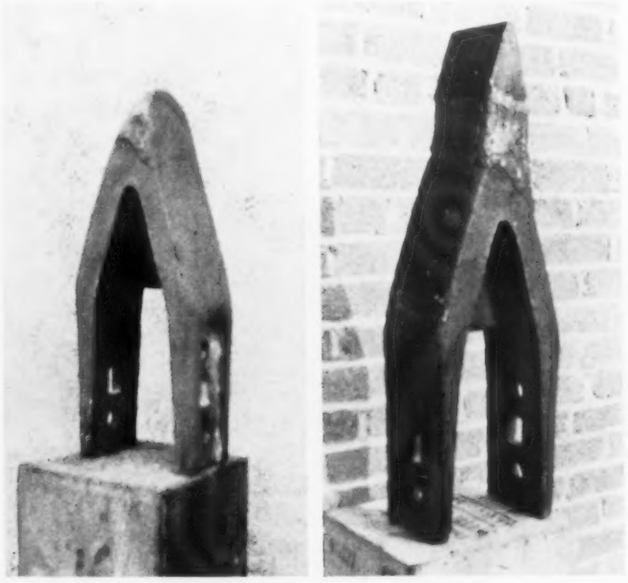
Manganese-steel castings were first made in America in 1892 and since that time an industry that produces nearly 100,000 tons of castings, forgings and other rolled products annually has developed. These products range from the small casting weighing a few ounces up to pump shells and crusher plates and heads weighing 15 to 20 tons each.

From 1882 to 1928 apparently no new developments of a worth-while nature were made in the standard Hadfield manganese steel, but in 1928 it was discovered that the addition of nickel, about 2½ to 3½ per cent., and the lowering of the carbon to .70 to .90 developed a steel that was practically cast in the austenitic state. It was recommended, however, that all castings made of this manganese steel containing nickel, should be heated to about 1,800 deg. F. and allowed to cool in the air, which gave them all the general characteristics of Hadfield 11- to 14-per cent. manganese steel, namely, toughness, shock-resisting properties, and the ability to work-harden on the surface to Brinell hardness ratings up to 550. This same steel resisted temperatures that 11- to 14-per cent. manganese steel could never be subjected to, and it was found that it could be exposed to a temperature not in excess of about 1,100 deg. F. for a short time and about 800 deg. F. for a long period. Further experiments with manganese steel containing nickel developed the fact it could be used for a welding electrode, due to its air-toughening properties, and that surfaces welded on worn-down manganese-steel castings would give approximately the same degree of resistance to im-

pact and abrasion as new 11- to 14-per cent. manganese-steel castings.

Prior to the development of nickel-manganese steel very little had been accomplished by welding, due to the fact that when a welding electrode was of ordinary steel the added material was deficient in strength, ductility and wear resistance, but if an electrode of the same composition as 11- to 14-per cent. manganese steel was used the result was usually worse, as the slow cooling of the weld deposit causes a partial transformation of the internal structure, resulting in its becoming brittle, very often breaking due to the cooling strains and its always being under impact.

For a number of years, however, the manufacturers of Hadfield 11- to 14-per cent. manganese-steel castings were able to weld imperfect castings, but only in their own shops, where they were able to reheat the treated castings. This work was difficult to accomplish in the field, however, and when manganese-steel rods of the Hadfield composition were used for repairing broken or worn-down 11-



Before-and-after views of a shovel-dipper tooth retipped by the use of new forged wedges and a nickel-manganese-steel welding job.

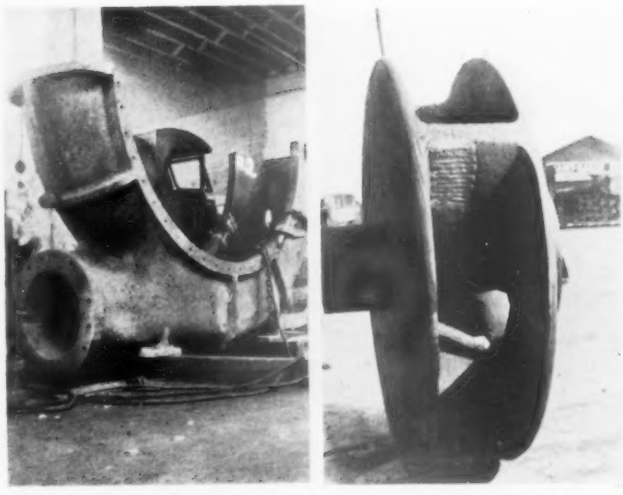
to 14-per cent. manganese-steel castings in the field the welders resorted to quenching the weld deposit. But, inasmuch as the deposit was never within the proper quenching range, this water-quenching had little effect on the deposited metal.

The development of nickel-manganese steel in the form of a welding electrode has made it possible for all this work to be done in the field and very often 5 lb. of deposited metal will reclaim castings weighing from 300 to 500 lb., resulting in great economies due not only to the savings effected in welding, but also to the very fact that often it takes several weeks to obtain a new casting and it is necessary to go to the expense to remove the old one and replace it with the new one.

The reclaiming of 11- to 14-per cent. manganese-steel castings by welding with 11- to 13½-per cent. nickel-manganese-steel welding electrodes is work that the ordinary welder can attempt and feel sure of getting good results. The first thing any welder should know is how to recognize manganese steel. This is very simple, inasmuch as manganese steel is non-magnetic and a simple 10c.-store magnet will determine once and for all if the part to be welded is manganese steel or some other steel. The next thing is to see that the polarity of the machine is reversed and that only the lowest amperage is used. It is better to use 11- to 13½-per cent. nickel-manganese-steel welding electrodes without any flux coating with direct current, inasmuch as they are air-toughening, and coated electrodes that lay a slag deposit over the weld metal tend to drive the heat into the parent metal and the distinct advantage of toughening the welds in the air is lost. Never lay down more than 2 in. of weld deposit and then peen it while it is hot. This peening relieves the strains due to contraction and also gives underneath hardness which is never found in a new 11- to 14-per cent. manganese-steel casting. In other words, you have a forged weld deposit which is of a much closer grain structure than that ordinarily found in a new 11- to 14-per cent. manganese-steel casting. Do not quench the weld deposit when using 11- to 13½-per cent. nickel-manganese-steel welding electrodes as this will set up hair-line cracks, which may later develop into larger cracks and cause failure.

The best practice to follow when reclaiming worn-down manganese steel is to skip from place to place on the castings, so that the parent metal is at all times kept as cool as possible. In attaching wedges to worn-down shovel and dipper teeth it is good practice to do four at a time; that is, lay one bead on one tooth and then go on the second, third, fourth, etc.

Eleven- to 13½-per cent. nickel-manganese-steel welding electrodes play a very important part in the maintenance of crusher parts, buckets, pump shells, impellers, etc., used in quarries and in sand-and-gravel plants. Many of the small quarry companies



This pump shell was reclaimed and the pump impeller at the right was rebuilt with nickel-manganese-steel applicator bars and welding electrodes.

throughout the country that are not equipped with their own electric-welding facilities are calling in their local electric-arc welder, who is usually in a position to do this work promptly and save costly shut-downs. The larger material-handling companies usually have their own electric-arc-welding facilities and are in a position to maintain their equipment at nearly the original size and get the benefit of more efficient crushing and handling.

Large-shovel operators have found it good practice to remove their worn shovel teeth much sooner

Manganese-steel crusher head with nickel-manganese-steel applicator (filler) bars attached, ready for filling-in weld.

than they used to prior to the development of nickel-manganese steel; in other words, teeth that are kept up to their normal size are sure to be more efficient than those that are allowed to wear down until it becomes necessary to scrap them.

Nickel-manganese steel has found its place in screens, where a sufficient amount of impact and abrasion is present to justify work-hardening the surfaces and many operators who have been compelled to use punched plate are now using nickel-manganese-steel woven-wire cloth.

Handy Tool for Quarry

Installed last summer in the Speed, Ind., quarry of the Louisville Cement Co., this Trackson tractor and high-shovel has proved its worth. Here it is digging and transporting rock to grade.

Diesel Wins in Silica Stripping

The two tractors looked very much alike to the casual observer. They bore the same manufacturer's name. They were about the same size and of similar track-type construction. They were both pulling rotary scrapers of identical size and make. But there the comparison stopped.

For the engines of the two "Caterpillars" had little in common. True, both were approximately 35 hp., but one was of Diesel and the other of gasoline-power design. The two machines are owned by the Silica Products Co. of Kansas City, Mo., and the job to which they were assigned was the removal of heavy overburden at Clay Spur, near Osage, Wyo.

K. K. Wyatt, general manager of the company, had heard much about Diesel performance and economy and saw the opportunity to check up on the claims, with the firm's two tractors, Diesel and gasoline, working side by side on the same haul, load and hours of work. Careful records were ordered kept, and here are the results as reported by Manager Wyatt:

The overburden, consisting of volcanic conglomerate, hard and tough, was loosened with a ripper and removed to a depth of 10 ft. The hauls averaged 200 ft. in length.

A representative month on the job showed that the Diesel's fuel cost was less than one-sixth of the

Diesel and gasoline-powered tractors stripping silica-sand deposit.

gasoline tractor's fuel expense. The Diesel, burning fuel oil costing 3.39 c. a gal., had a fuel cost per 8-hr. day of only 48.8 c., and this included gasoline for the starting engine. In 203.5 hr. of operation it consumed an average of 1.69 gal. of distillate per hr., a total of 344 gal., costing $12.41. In comparison, the gasoline tractor burned 2.59 gal. of 15.5-c. fuel per hr. for 202.5 hr. during the same month, a fuel consumption of 525 gal., costing $81.20.

The fact that the Diesel tractor saved $68.79 in fuel expense in one month does not tell all the story. Its superior pulling ability was demonstrated by the fact that its production for the month was approximately 10 per cent. greater than that of its gasoline brother. The Diesel moved 208 cu. yd. per 8-hr. day at a fuel cost of only 2.4 mills per cu. yd. The gasoline machine handled 188 cu. yd. at a fuel expense of 1.7 c. per cu. yd.

Looking down the main conveyor at the Anunsen plant. Hopper and scraper below with stock-piles in distance.

NEED ONLY THREE MEN FOR CAPACITY PLANT OPERATION

A NEW sand-and-gravel plant of medium size was put into operation late in the summer of 1935 by the Anunsen Co., Salem, Ore. This plant, with a capacity of 50 cu.yd. per hr., is located on an 18-acre property ½ mi. north of Salem. One of the features of this plant is its flexibility, which makes it possible to produce practically any desired size of crushed or uncrushed material. That this is achieved without unduly complicating the plant is evident from the fact that only three men are required to operate the plant at capacity.

Much of the equipment in this plant was brought from the plant of the Salem Sand & Gravel Co., which was operated by the same interests for five years. This plant was dismantled in May, 1935, before the new one was built. The new equipment purchased for this plant included a vibrating screen, a deep-well pump, conveyors, drive belts, motors, etc.

The deposit is said to be an old bed of the Willamette River whose present channel is about ½ mi. from the plant. The overburden on the deposit averages about 1 ft. in depth and is not removed. The present operations extend to a depth of about 60 ft., where a 7-ft. bed of clay is encountered. Below the clay the gravel is known to extend 230 ft.

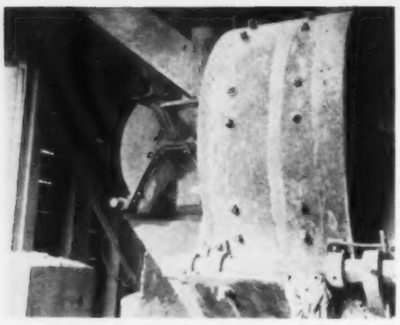
Material is excavated by a 2-cu.yd. Sauerman Crescent scraper operated from a 100-ft. mast of Oregon red fir. A special pulley allows the scraper to be returned to the pit in the same manner as a cableway excavator but loaded it operates as an ordinary scraper. The scraper is operated by a 2-drum Willamette hoist driven by a 75-hp. G. E. motor through Gates Vulco-Rope. With this system material can be excavated within a radius of 500 ft. Installation of a 140-ft. mast to increase the range of operations is contemplated.

The scraper discharges the sand and gravel into a hopper from which a reciprocating feeder carries it to the main 18-in. by 200-ft. belt-conveyor running to the plant. The conveyor discharges its load into a flume 10 ft. long where water is added before the material passes to the primary revolving screen. The screen has a 42-in. by 22-ft. main barrel with ½-, 1½- and 2½-in. openings and a jacket with ¼-in. openings. The main conveyor is driven by a 25-hp. variable-speed motor and drives the feeder from its tail pulley. The screen is driven by a 10-hp. Westinghouse motor.

A part of the fine material which passes through this jacket is flumed to a Telsmith settling tank for the production of concrete sand which is discharged direct into bin storage. The remainder of the fine material goes to a Stephens-Adamson conical screen which has ⅛-in. openings and from which the coarse material goes direct to storage as pea gravel. The minus ⅛-in. material goes to an Allen cone and then to storage as masons' sand. The three coarse sizes of material from the first screen go direct to storage. The conical screen is driven by a 5-hp. G.E. motor.

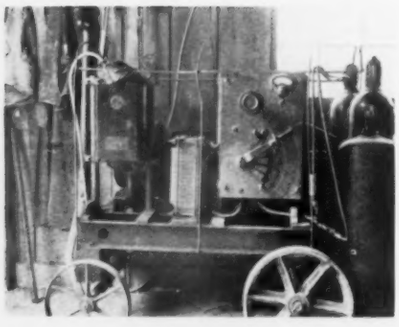
The oversize (plus 2½-in.) material from the first screen goes to an 18-in. by 10-ft. belt-conveyor equipped with a magnetic head pulley for the removal of tramp iron. The conveyor discharges it into a 15-cu.yd. bin which feeds a 36-in. Symons disk crusher set to crush to 2-in. minus. The crushed gravel is taken on a 16-in. by 65-ft. belt-bucket-elevator to a 3-ft. by 10-ft. Niagara triple-deck vibrating screen. Screen cloth with 1¼-, ¾-, ½- and ¼-in. mesh is used with two sizes on the bottom deck. The three coarse "through" sizes go direct to storage and the minus ¼-in. material to a Telsmith tank for dewatering before going to storage. The oversize conveyor is driven by a 5-hp. motor, the disk crusher by 50- and 75-hp. motors.

Scraper discharging at hopper. Hoist-house and conveyor to plant at the right.

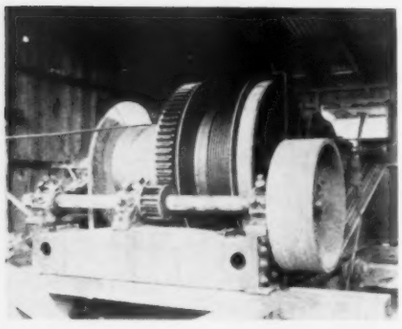


The two disk-crushers which are used in the production of crushed gravel.

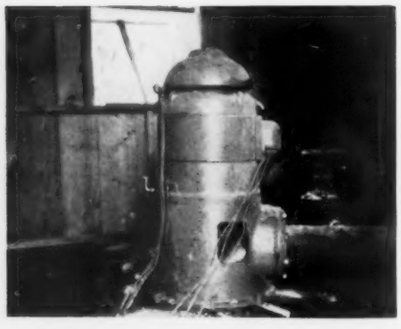
Preliminary sizing is done by this 42-in. by 22-ft. revolving screen.



This electric welding outfit is an important piece of shop equipment.



Hoist which operates the drag-scraper, showing multiple V-belt drive.



Water for washing the material is furnished by this 500-gal. per min. deep-well pump.

The oversize (1¼- to 2-in.) material from this screen is taken by a 16-in. belt-conveyor operating on 50-ft. centers to a 15-cu.yd. bin feeding a 24-in. Symons disk crusher. The same bucket-elevator returns the recrushed material to the vibrating screen. Waste water from all the sand tanks flows through one flume to another Allen cone which settles out a garden sand. This is sold for lawns, flower beds, golf greens, etc. This disk crusher is driven by 20- and 15-hp. motors and the elevator by a 10-hp. motor.

The storage bins have a total capacity of 150 cu.yd. with six compartments for crushed material and six compartments for uncrushed material. Trucks are loaded below these bins through sliding gates. No railway shipments are made.

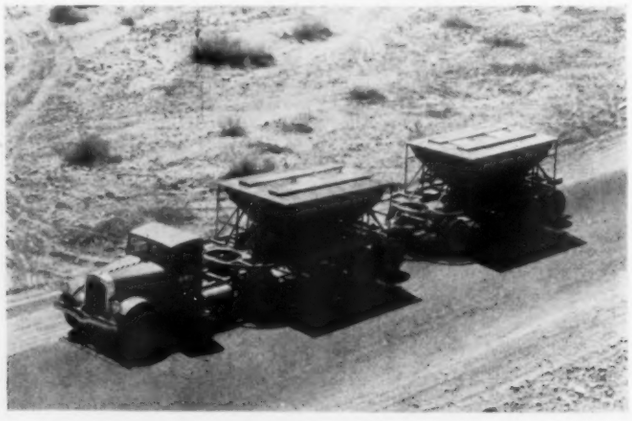
Wash water for the plant is supplied by a deep-well pump having a 12-in. casing and a capacity of 500 gal. per min. This well was driven to a depth of 228 ft. to get an adequate supply of water. An Allis-Chalmers centrifugal pump in the water line furnishes adequate pressure. Sprays are used at the screens to wash the product thoroughly. Rex Stearns Timken-bearing conveyor idlers are used.

The Anunsen Co. sells its products at wholesale only. Most of the retail distribution is made through the Oregon Gravel Co., a separate organization. This company operates a fleet of seven 1½- and 2½-ton trucks for delivery purposes. Four Ford V-8 trucks are included in the fleet.

Near the plant are garages for the trucks and a repair shop housing an Industrial Controller Co. electric welding unit, acetylene welding equipment, a lathe, a forge, etc. There are also labeled racks with a complete stock of bolts, nuts, parts, etc.

The officers of the Anunsen Co. are: F. S. Anunsen, president and manager; Paul B. Wallace, vice-president and secretary; and Joseph H. Albert, treasurer.

BULK CEMENT ON THE DESERT



Bulk cement en route from the Mecca, Cal., siding of the S. P. Rwy. to the Colorado River aqueduct. The Sterling truck is powered by a Cummins Diesel engine and the entire unit rolls on 26 Goodrich Silvertown pneumatic tires.

SPECIAL CEMENTS AND THEIR PRODUCTION

By PROF. DR. HANS KÜHL
Berlin-Lichterfelde

THE statements made by P. H. Bates in the year 1933 before the American Society for Testing Materials [1] and on other occasions concerning the creation of special cements attracted attention also in Germany and other countries of Europe, for here, too, the need for the production of special cements has become more and more apparent with the advancing development of construction engineering.

The need for evaluating cements according to new points of view found its first expression in the revision of the standard specifications of many countries, especially in the introduction of the testing of plastic instead of stiff ("earth-dry") mortar. Switzerland pioneered in this and Italy soon followed her; but in Germany, Sweden and other countries plastic testing has also been introduced now alongside stiff-mortar testing, and here also the opinion is growing that stiff-mortar testing should be replaced by plastic testing. Finally, it signifies a step in the same direction of a beginning specialization that in the new Swiss standards, specifications for the testing of cements for shrinkage were for the first time adopted.

Passing over the distinction between "ordinary" and "high-early-strength" (high-test) cement, a specialization going beyond this distinction has already been worked out in Sweden. There, alongside the "ordinary" Portland cement and the (high-test) "special cement," a third variety of cement is established, which is designated as "silicate cement"; the latter is a high-silica cement resembling the American bisilicate cement. For certain purposes ordinary Portland cement and silicate cement are also furnished with a puzzuolan admixture, so that in this way altogether five different types of cement are available.

In Germany the question of special cements was emphasized by an article which I published [2] under the title *Standardization Problems* in the spring of 1934. At that time I set out four types of cement as particularly important for practical purposes, which are: as a first type a cement with high initial strength (reinforced-concrete cement), as a second type a cement with low shrinkage (road-building cement), as a third type a cement with low heat liberation (cement for mass construction), and as a fourth type a cement with high resistance to chemical attack (corrosion-resistant cement).

These proposals have already been put into effect to the extent that the previously existing classification of cements into "ordinary" and "high-test" cements was supplemented by the prescribing of special specifications for the furnishing of cements for the construction of the German state automobile highways (Reichsautobahnen). Through these purchase specifications a type of cement with lower tendency to shrinkage has been developed, as I had required of Type 2 (road-building cement).

Regarding future development it can probably be expected that as the next type a cement with the lowest possible heat development (cement for mass construction) will follow. There is a great need for the introduction of such cements, as of course, the large dam works in America have particularly shown; furthermore, the way for the testing and evaluating of such cements has already been indicated by the tentative specifications for Portland cement for Boulder Dam.

The development of a cement of Type 4 (corrosion-resisting cement) will probably be most difficult, for here there seems to me still to be a complete lack of the prerequisites for the formulation of an adequate testing method. Nothing that up to now has been proposed for testing for chemical resistance is likely to be suitable as a basis for the writing of standard specifications.

This being a brief sketch of how, seen from the German point of view, the future development of special cements will presumably take shape, it is then no less interesting to investigate what methods can be followed by the cement industry in order to effect the specialization required by construction practice. Cement plants will always have to have regard for a greatest possible simplicity in the plan of their operations, and consequently there are only a few means which come into consideration for the practical production of special cements.

[1] P. H. Bates, *Proceedings American Society for Testing Materials*, June, 1933.

[2] H. Kühl, *Zement* 23, Nos. 12, 14, 16 (1934). Abstracted in PIT AND QUARRY, July, 1934, p. 53.

In case of the manufacture of *cements with high initial strength* the emphasis will probably always lie on the clinker, that is, on the production of a clinker of most favorable possible composition and best possible properties of burning. Now the properties of the clinker are primarily determined by the amount of the lime content, for no matter how the hydraulic factors may be proportioned with respect to one another, highest strength will always be obtained only when the raw mix has an optimum lime content. The only question is where this optimum lies.

In an article which I published some time ago in this magazine [3] I asserted that a correct evaluation of the admissible lime content in Portland cement can never be attained if Portland cement is considered as a system in chemical equilibrium, as is the presumption for the application of the formulas of R. H. Bogue for the calculation of the individual clinker minerals.

I stated at that time that in the case of clinker we have to do with a "congealed equilibrium," and I supported myself therein on the scientific investigations of my collaborators E. Spohn [4] and S. Solacolu [5] as well as on the theoretical studies of L. A. Dahl.[6] Thus I arrived at the conclusion that in practical cement burning the full lime saturation is not reached, but that only that amount of lime can be combined which corresponds to the congealed equilibrium at the sintering temperature. I designated this amount of lime as "lime standard" and for it set forth the following formula:

$$CaO\ (Standard) = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3.$$

In the meantime our knowledge concerning the constitution of Portland cement clinker has had a special enrichment through the investigations of F. M. Lea and T. W. Parker.[7] These investigators studied the fusing equilibria in the quaternary system $CaO—SiO_2—Al_2O_3—Fe_2O_3$; they too come therein to the conclusion that in Portland cement clinker we have to do with an equilibrium congealed at the sintering temperature, and they give for the highest amount of lime which can be combined in such a congealed equilibrium the following formula:

$$CaO\ (maximum) = 2.8\ SiO_2 + 1.18\ Al_2O_3 + 0.65\ Fe_2O_3.$$

Lea and Parker have already pointed out the close correspondence between their formula and mine and it seems to me that the statements which I made almost three years ago in this magazine have found an excellent verification in the researches of Lea and Parker. I am of the opinion that the concept of the "lime standard" I developed should be brought into agreement with the researches of Lea and Parker and be redefined *so that by lime standard is to be understood that amount of lime which in the sintering system can be combined by the hydraulic factors*, and this amount of lime be represented by Lea and Parker's improved formula.

For practical operations the great significance of the lime standard lies in the fact that it indicates to the cement manufacturer that amount of lime with which he can reckon as maximum content under normal conditions. Of course, we are dealing here not with a mathematically exact formulation, but only an *approximation*, for the lime standard can vary toward one side or the other, as L. Forsen [8] has particularly pointed out, under the most varied influences, such as the nature of the raw materials, method of preparation, rate of burning and cooling and above all the content of fluxes in the mass. This, however, does not at all change the fact that the manufacturer has in his hand with the lime standard a figure by means of which he can judge most simply the capacity of his plant for producing the attainable lime combination.

The researches of Lea and Parker have also furnished the explanation for another observation which I made a number of years ago, namely, for the determination that cements of especially good initial strength are obtained if the silica content is greatly reduced and consequently the content in iron oxide correspondingly increased. The patents [9] which I took out at that time on this discovery have in some countries led to the production of a special cement to which my name has been assigned (Kühl cement); in other countries my reports were skeptically received because it was not possible to perceive exactly why the proportioning of hydraulic factors I proposed should yield cements with especially good strength properties. Now at last my observation has found its scientific explanation through F. M. Lea.

Lea has in fact pointed out that in cements of normal composition the sinter melt is comparatively *low in lime* as compared with the lime combination in the solid phases. Conversely, it develops that in the case of cements of the type of Ferrari cement ($Al_2O_3 = 0.64\ Fe_2O_3$) [10] the sinter melt is considerably *higher in lime* than the solid phases resulting from the sintering. It is obvious that between ordinary Portland cement and Ferrari cement there must be a region in which sinter melts and solid phases have the same or approximately the same lime content, and in which therefore there result especially favorable conditions for a high combination of lime and for the attaining of almost complete lime saturation. Cements of this kind lie in the region demarcated by my patents.

But there is another thing in this connection. Lea calculated that the amount of the sinter melts increases when the ratio of alumina to iron oxide (the alumina modulus) approaches the numerical value 1.38, and especially so when the content of the cement in alumina and iron oxide is high. These assumptions also concern the cement discovered by

[3] H. Kühl, PIT AND QUARRY, March, 1933, p. 36.
[4] E. Spohn, *The Lime Limit of Portland Cement and the Technical Properties of Its Clinker Minerals;* dissertation, Berlin, 1932.
[5] S. Solacolu, *The Utilization of Rankin's Diagram* $CaO — SiO_2 — Al_2O_3$ *in the Practice of Cement Burning;* dissertation, Berlin, 1932.
[6] L. A. Dahl, *Rock Products* 35, No. 12 ff. (1932).
[7] F. M. Lea and T. W. Parker, Phil. Trans. Roy. Soc. 234 (A), 1-41 (1934); Building Res. Techn. Paper 16; F. M. Lea, Cement and Cement Manufacturing, 8, 29 (1935).
[8] L. Forsen, *Zur Chemie des Portlandzementes*, p. 28 (Berlin, 1935). Abstracted in PIT AND QUARRY, April, 1935, p. 58.
[9] U. S. A. Patent 1,594,178; British Patent 231,535; D. R. P. 457,621.
[10] F. Ferrari, *Tonindustrie-Zeitung* 59, 533 (1935).

me, so that the relation between high lime combination and easy sintering furnishes the explanation for the fact that cements with especially high initial strengths are obtained right at the proportions of hydraulic factors I recommended.

While the production of a raw mix with low silica content and high content in iron oxide is seldom difficult for cement manufacturers, it is less simple to burn such a raw mix, for masses which sinter very easily have a greater tendency to caking and to the formation of rings. However, lining the kilns with Radex magnesite refractory affords a particularly efficient remedy against damages of this kind.

In Europe we have for a long time hesitated to line cement kilns with magnesite refractory, because the large coëfficient of expansion of burned magnesia makes the refractory very sensitive to repeated cooling and heating. This difficulty is eliminated by the special properties of Radex magnesite. On the other hand the good heat conductivity of this material is recognized as disadvantageous. A cement plant which was able to burn its cement in the Lepol kiln with a heat consumption of 90,000 to 95,000 calories per 100 kg. of clinker had to learn that this especially good heat consumption took an increase to 105,000 to 110,000 calories when the kiln was lined with Radex magnesite in the sintering zone. The high heat conductance also revealed itself in the fact that the outside kiln shell rose to a temperature of over 400 deg. C.

It seems that it will be necessary to protect a sintering zone lined with magnesite against heavy heat losses by placing an insulating layer between; up to the present, however, this problem has not yet been satisfactorily solved from the constructive point of view, although a practical insulating material is available to us in highly porous bricks.

Short rotary kilns, preceded by an apparatus for heat transfer to the raw material, such as a Lepol grate or a slurry drier (calcinator, concentrator) are particularly well adapted to the burning of masses that sinter very easily and have a tendency to cake; such devices make it possible to regulate in better fashion the course of the material through the kiln toward the conclusion of the burning process. Short rotary kilns coupled with preceding preheating apparatus appear to have as great an advantage over long kilns in this excellent capacity of control as in their favorable heat economy.

For the production of cement with high initial strength a good grinding will be indispensable even with the best clinker, although it has been shown that clinker with low silica content and high content in iron oxide yields excellent strength figures even with comparative coarse grinding. For the rest it seems to depend not only on the fineness but also on the nature of the grinding; in fact I have been able to establish at several cement plants that the effect of the grinding process, both as regards the capacity of the mill and as regards the strength properties of the ground cement, was improved if the mill (compound mill) was cooled by spraying with water.

There have also been numerous attempts to increase the initial strength of cements by means of chemical admixtures, and indeed it is known that certain effects, specifically in connection with compressive strength, can be attained through the admixture of ½ to 1 per cent. of calcium chloride. In spite of this established fact I am of the opinion that an admixture of calcium chloride to cement should be avoided; for one thing, because such an admixture facilitates the rusting of reinforcing elements, and furthermore because the shrinkage of cements is affected in an uncontrollable manner by calcium chloride. In this I see a special danger, because shrinkage anyway is a phenomenon which we probably shall never be able entirely to regulate, for it lies in the nature of hydraulic hardening that is associated with shrinkage. Nevertheless there are *differences in the shrinkage behavior of cements*, concerning which the following may be said:

Great shrinkage occurs in connection with cements which are high in alumina, especially if higher content in alumina is associated with lower content in iron oxide. Accordingly, we have a way for the production of cements of low shrinkage if we increase the content in iron oxide so that the alumina furnishes the possibility of the formation of tetracalcium-aluminate-ferrite. If, as in the case of Ferrari cement, the alumina is completely converted into this compound, we obtain the minimum shrinkage; unfortunately, however, in Ferrari cement the capacity of hardening is not particularly high, so that wherever in addition to low shrinkage, high strength is also required, it is well to choose a cement composition between Portland cement and Ferrari cement.

Almost all admixtures which are added to Portland cement increase its tendency to shrinkage; this is especially true of an admixture of trass and other puzzuolans. The increase in the tendency to shrinkage is comparatively slight in the case of the admixture of blast-furnace slag.

The tendency of cements to shrinkage is also increased through very fine grinding; for that reason the terms of delivery for the state automobile highway prescribed that in the cements to be used the fineness of grinding should not go below 5 per cent. residue on a screen with 4,900 meshes per sq.c.

While it has been believed for a long time that the formation of cracks can be avoided by increasing the tensile strength, and later we have been of the opinion that the danger of cracking could be eliminated by the development of "shrinkage proof" cement, concrete technologists are to-day convinced that in the occurrence of cracks still a third property of cement is of considerable importance, namely, elasticity. Investigations by A. Hummel [11] have already shown that the elastic properties of cement are also dependent on the chemical composition, even if they have still left open the question of the regularity of this relation.

Finally, I believe that phenomena of fatigue also contribute to the formation of cracks, for if the oc-

[11] *Tonindustrie-Zeitung* 59, 939 (1935).

currence of cracks—for example, in road slabs—depended only on the properties of the cement it ought to appear much earlier than it ordinarily is observed.

Cements with low development of heat in setting can be produced in different ways. The simplest means consists in a reduction of the lime content; this reduces both the heat of hydration as such and also the rate at which the heat is liberated.

Besides the lime content, the content in alumina contributes to the development of heat and especially those aluminas which are available for the formation of tricalcium aluminate. Consequently, we obtain cements with decreased heat development when we increase the content of iron oxide and thereby convert the alumina in the greatest possible amount into tetracalcium-aluminate-ferrite.

Finally, the development of heat is also diminished through puzzuolan admixture. Of course, puzzuolan cements should, if the replacement is complete, show the same heating effect as pure Portland cements; as puzzuolan cements, however, react only slowly, the quantities of heat are only slowly liberated, and accordingly the possibility of conducting the heat away is afforded exactly as in the case of cements with low lime content.

All methods which result in the reduction of the heat development are associated with losses of strength, which of course is an obvious thing, for development of strength and liberation of heat are two effects, running parallel to one another, of the chemical reaction between cement and water.

Here it may be remarked that it is possible to produce cements from basic blast-furnace slag with high alumina content, which as regards both their low tendency to shrinkage and their low development of heat in connection with high initial strength appear especially suitable for many purposes. Such cements are produced according to a discovery of mine [12] in which slags of the indicated kind are ground with high admixtures of gypsum. (up to 10 per cent. and over). Admixtures of sharp-burned gypsum or of anhydrite, as have recently been patented in several countries, appear particularly efficient.

The corrosion of cement construction works by chemical attacks, particularly by the action of acids and salts, is another thing which can never be entirely combated by the creation of special cements, for there will always be substances which enter into reaction even with the special cement and destroy it. Therefore, also, it is vain to demand of a cement that it shall simply be resistant to all chemical attacks; rather, we shall have to employ different cements according to the nature of the chemical attack.

So far as the attack of sulphatic waters is concerned, we have in alumina cement a material which is practically unattackable. On the other hand, alumina cement shows itself less resistant to solutions of magnesium salts and many other substances than Portland cement.

The question of how far the chemical resistance of Portland cements can be improved through the admixture of lime-combining materials is still much debated. At any rate it can not be doubted that pure Portland cement in its hardening liberates lime hydrate, that it is thereby particularly endangered and that it is better if the soluble hydrate of lime is converted to the insoluble state by combining with hydraulic admixtures.

More important than all chemical methods for combating the danger of corrosion, however, is the appropriate treating of the cement. Construction works which are exposed to chemical attacks must above all things be dense; if a dense concrete is actually attacked by a corrosive fluid, it soon coats itself anyway with a protective layer of decomposition products which hinder further attack. If on the other hand we have to do with a porous concrete in which a corrosive fluid can penetrate or through which it can even percolate, even the best special cement is of no avail, for there is no cement which under steady percolation of salt solutions and even of pure water is not finally destroyed through hydrolysis.

Everywhere where success is less to be expected from the cement itself than from appropriate execution of construction the workability of concretes plays a very important *rôle* along with the properties of cements already discussed. Up to the present, however, we have here depended on empirical experience. Weakly-burned cements can be better worked than hard-burned rotary-kiln cements; finely-ground cements have a greater workability than coarse cements; and workability is increased by admixture, if natural puzzuolans, brick dust and the like are concerned, decreased, if the admixtures consist of hard vitreous components, such as blast-furnace slags and the like.

For the production of especially workable cements, there has been recommended in America, so far as I have become aware, the admixture of oil and other organic substances. Such attempts can only attain an actual success if we succeed in finding suitable working methods for the testing of cements for workability. A first premise for this is afforded in the so-called slump test; in case of this, however, we are still concerned with a primitive enough process which needs further development fully as much as the processes so far proposed for testing for cracking and for chemical resistance.

[12] D. R. P. 237, 777.

Gypsum Makes Realistic "Snow" for Staging Wintry Movie Scenes

Gypsum has one use not generally known. In addition to its everyday employment in plaster, in fireproofing and insulating, in blocks, and in other products, it forms the "snow" scenes for motion pictures. High-grade gypsum is white, and in some pictures the snowdrifts are so realistic that they defy detection as anything but snow.

Newest of the Woodstock Slag Co. plants. Feed and reclaiming conveyors are shown with screening and storage tower at right, washing and loading building at left.

SLAG PLANT BUILT LAST YEAR IN ALABAMA USES RADIAL STORAGE SYSTEM

A NEW plant was placed in operation late last year at Anniston, Ala., by the Woodstock Slag Corp., which has for many years operated plants at Birmingham and Woodward, Ala. The latter were described in the July 17, 1929, issue of PIT AND QUARRY after important improvements had been made to them.

The Anniston plant is located within ¼ mi. of the plant of the Monsanto Chemical Co. from which the raw crushed slag is secured. Hopper-bottom railway cars are used to haul the slag to this plant. The slag is discharged from the cars into a track hopper from which it is dropped through two gates on the 16-in. by 160-ft. main plant conveyor. The conveyor discharges the slag direct on the 3-ft. by 12-ft. Symons double-deck vibrating screen which is equipped with ¾-in. and 1¼-in. cloth on the top deck and has a divided bottom deck with ½-in. and 1-in. cloth. With this arrangement five sizes of material are produced. Four sizes are chuted direct to storage and the minus ½-in. material goes to a 3-ft. by 5-ft. Tyler Hum-mer single-deck screen with ¼-in. cloth. The two fine sizes from this screen are chuted direct to storage.

The Kern storage system used at this plant is of standard design with six radial compartments whose partition walls support the screen building. This unit has a live-storage capacity of material reclaimable by gravity of 400 tons. A Sauerman ¾-cu.yd. Crescent scraper is used to carry material to and from dead storage. The tail pulley of this scraper is attached to a steel ring encircling the tower and it is operated by a P&H No. 206 gasoline crane. At the present storage radius of 160 ft. about 50,000 tons of material can be stored.

Material falls from storage through drop chute gates on the loading belt-conveyor which is 24 in. wide and operates on 150-ft. centers. Each gate has 12 graduations so that any desired mixture of sizes can be blended while loading. The conveyor discharges the slag on a single-deck Hum-mer screen with ⅛-in. openings to insure the removal of any dust which may have formed in handling. This screen is equipped with sprays for washing when certain grades of aggregates for bituminized roads are being produced. This screen also allows a further sizing of the fines. City water at 90-lb. pressure is used in washing.

Scraper moving material to dead storage.

Double-deck sizing screen. Feed box at left.

Raw-material conveyor to tower.

Gasoline-powered crane which operates the ¾-cu. yd. scraper between live and dead storage.

Slag is loaded into cars from this screen through chutes and is shipped over the two railways, the L & N and the Southern, serving Anniston. The use of power in moving both empty and loaded cars at this plant has been eliminated. The cars filled with raw slag are brought to the plant, usually 3 or 5 at a time, by a Southern Ry. switch engine, and are pushed past the hopper to a siding long enough for 7 cars. An 8-per cent. grade on this track allows these cars to be moved by gravity to the hopper, where the track is level, for unloading. When emptied, each car is started with a bar and proceeds by gravity down a 1-per cent. incline, which is followed by a .6-per cent. grade, past a switch to the Southern Ry. sidetrack to be hauled back to the Monsanto plant. Empty cars to be loaded are brought in from either railway and pushed past the plant loading chute to another side-track with a similar grade but with a capacity of 11 cars. The same procedure is followed in moving these cars to the loading building and on to either of the two side-tracks for shipment. The switch for the two plant-storage tracks is below the plant so that cars of raw slag can be discharged and empty cars can be loaded with finished material simultaneously. All the switching is done by the railroads.

About 200 tons of slag are brought from the Monsanto plant daily. This is electric-furnace slag weighing about 2,600 lb. per cu.yd. The slag plant actually has a productive capacity of 40 tons per hr. As the Symons screen has a capacity considerably in excess of this figure, its discharge end has been raised 11 in. above the feed end. With this arrangement, according to Geo. A. Mattison, Jr., vice-president and general manager of the company, even better sizing is obtained with ample capacity. The loading-out capacity is now about 150 tons per hr. and this could be increased by speeding up the 24-in. loading belt.

The simplicity and economy of operation of this plant are evident from the fact that only five men are required when all departments are in operation. The power requirements are also very low. The Symons screen is driven by a 5-hp. G.E. motor through Allis-Chalmers Texrope. The two conveyors are driven by 5- and 10-hp. electric motors through Jones spur-gear reducers.

Quarry Safety Shows Slight Gain

FINAL reports received by the U. S. Bureau of Mines covering accidents and employment at stone quarries, crushing and screening plants, cement mills, and lime kilns for the calendar year 1934, when compared with similar reports for 1933, showed an increase in the number of workers and man-hours of work and a slight but insignificant decrease in the death and injury rates from accidents. Increased employment was reported from Pennsylvania, Virginia, Iowa, Kansas, West Virginia, Ohio, Michigan, Illinois, California, Texas, Minnesota, and Maine; of these, all but the last five States reported lower accident rates in 1934. The average employee worked 204 days, a gain of 21 days over the preceding year, but the length of workday declined from 7.74 hours in 1933 to 7.27 hours in 1934.

Reports from operating companies showed that 64,331 men were employed in 1934, a gain of 4 per cent. over the previous year. The number of man-hours of employment increased 8 per cent.

Sixty men were killed and 3,924 were injured by accidents during the year, resulting in an accident rate of 41.8 per million man-hours of employment, compared with 42.1 in 1933. Of the fatalities, 45 occurred inside the quarries and 15 at the outside works. The accident rate was 70.2 per million man-hours for men working inside the quarries and 23.5 for men employed outside the quarries.

Novel Silica Recovery Method

Blasted silica sandstone is cast by a Bucyrus-Erie steam shovel into the path of a Sauerman scraper in the workings of the Langworthy Silica Co., near Clayton, Ia. After a scraper haul of about 300 ft. the material is broken up by a hydraulic nozzle and washed over revolving screens.

MEN of the INDUSTRY

DEXHEIMER PHOTO

STEPHEN STEPANIAN

IT is a long way from Constantinople to Columbus, O.—from a banking parentage to the sand-and-gravel industry. In 1902 Mr. Stepanian came to Columbus from the Orient as a linguist, not as an engineer. He spoke seven languages, but he became an engineer with the Jeffrey Manufacturing Co. By 1910 he had enough of engineering in the line of gold dredging, coal mining and quarrying to assume management of a small sand-and-gravel plant. Ten years of intense study followed during the pioneer days of that industry and in 1920 he became vice-president and general manager and built the first modern plant of the Arrow Sand & Gravel Co. In 1926 he built a second plant. He is still connected with the Arrow company and is vice-president and general manager of the Marble Cliff Quarries Co. of Columbus, O.

Mr. Stepanian served as president of the Ohio Sand & Gravel Assn. for four years, chairman of the Committee on Standard Specifications of the National Sand & Gravel Assn. for four years and at present is treasurer and a member of the Executive Board of the National Ready Mixed Concrete Assn. He is a member of American Concrete Institute and the American Railway Engineering Assn., the inventor of transit mixers, husband of a prominent cellist, and father of a Hollywood artist.

Personal Mention

Max Berns, advertising manager of the Universal-Atlas Cement Co., Chicago, Ill., is writing and syndicating a newspaper feature on the United States Constitution. Over a score of prominent daily papers have subscribed to the feature.

C. E. Jarchow has been elected controller of the International Harvester Co., succeeding the late Wm. P. Kelly.

P. F. Goltry of Chicago, Ill., has been selected as superintendent of the recently-acquired lime plant at Evans, Wash., by the United States Gypsum Co. The plant formerly was owned by the Idaho Lime Co.

F. M. Chapman, Jr., formerly a field engineer in Mississippi for the Portland Cement Assn., has been made district engineer in charge of the reopened Birmingham, Ala., office.

I. G. Kjosness has been made sales manager of the Washington-Idaho Lime Products Co., Orofino, Ida.

J. L. Guss of Toledo, O., has been appointed sales representative in northwestern Ohio and southeastern Michigan by the Consolidated Cement Corp. Mr. Guss' headquarters will be at Jackson, Mich.

H. D. Humphries is the district engineer in charge of the office recently opened at Richmond, Va., by the Portland Cement Assn. The Richmond office will supervise activities in Virginia and North Carolina.

Wm. T. Rossiter, formerly vice-president and general manager of the Cleveland Builders' Supply Co., Cleveland, O., has been named president, succeeding the late John A. Kling.

Coming Events

May 18-20, 1936. New York, N. Y.—Spring meeting, Portland Cement Assn. Waldorf-Astoria Hotel.

June 2-4, 1936. Hot Springs, Va.—Annual convention, National Lime Assn. S. Walter Stauffer, general manager, 927 Fifteenth St., N. W., Washington, D. C.

June 29-July 3, 1936. Atlantic City, N. J.—Annual meeting, American Society for Testing Materials.

October 5-9, 1936. Atlantic City, N. J. Twenty-fifth annual safety congress. W. H. Cameron, managing director, National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

Francis X. Ferney, formerly chief chemist for Southern Mineral Products Co., has become associated with the Bird Machine Works. He will do sales engineering and development work and will make his headquarters at South Walpole, Mass.

Walter E. Hawkinson has been elected treasurer of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., succeeding the late Raymond Dill who died a few weeks ago. Mr. Hawkinson has been with the company for 29 years advancing through various positions. Since 1926 he has held the post of assistant manager of the Tractor Division.

M. K. Frank, mine-car manufacturer and dealer in new and relaying rails, has announced a change in his Pittsburgh, Pa., address, the new location being in the St. Nicholas Bldg., 450 Fourth Ave.

Thomas J. Beesley, general superintendent and chief engineer of the Texas Construction Material Co. and The S. & G. Co., Houston, Tex., died March 26. He had been associated with these companies through their successive stages of development for nearly 20 years.

Walter T. Groner

Walter T. Groner, 56 years old, superintendent of the Southwestern Portland Cement Co. mill at Osborn, O., died at his home in Osborn Friday, April 17. He had been in failing health for a year and had been seriously ill for two months. Mr. Groner was a native of Greenville, Mich., and had been superintendent of the Osborn plant since March, 1925. Formerly he had served the Medusa Portland Cement Co. in a similar capacity at its mill near Toledo, O., and earlier in his life superintended the operations of cement plants at Newaygo and Petoskey, Mich.

Mr. Groner was a 32d degree Mason and a member of the Dayton Engineers' Club. He is survived by the widow, two sons and a daughter. Funeral services were held from the home in Osborn April 19, with burial in Memorial Park Cemetery, Osborn.

J. C. Pitman, owner and operator of three mines producing feldspar, mica and quartz near Penland, N. C., died recently.

Henry B. Farrar, president of the Cohutta Talc Co., Chatfield, Ga., died recently after a heart attack at his home in Dalton, Ga. He was 62 years old.

Silas B. Mason, 65, of Mason-Walsh-Atkinson-Kier Co., builders of the Grand Coulee Dam in the state of Washington, died in the hospital at Grand Coulee on the night of April 15, less than a day after he had suffered a heart attack.

George E. Olmstead, of New Haven, Conn., who has been operating as a manufacturer's agent in Connecticut, has joined the sales staff of the Morse Chain Co. He will continue to cover the state of Connecticut, being located in New Haven.

F. R. McMillan, director of research, Portland Cement Assn., Chicago, Ill., was elected president of the American Concrete Institute at its recent annual meeting, succeeding **P. H. Bates** of the National Bureau of Standards, Washington, D. C. **J. C. Pearson,** director of research, Lehigh Portland Cement Co., Allentown, Pa., was chosen vice-president.

H. M. Sharp, formerly vice-president of the France Slag Co., Toledo, O., has been made president of the Maumee Asphalt Paving Co., Toledo.

George C. Branner, state geologist of Arkansas, was elected president of the Association of American State Geologists at the recent annual meeting of the organization held at Washington, D. C. **Arthur Bevan,** state geologist of Virginia, was chosen secretary.

Harry J. Kicherer has been appointed works manager by the American Hoist & Derrick Co. of St. Paul, Minn. Mr. Kicherer comes from the Caterpillar Tractor Co., Peoria, Ill. He was graduated as a mechanical engineer from the University of Iowa and has had 20 years of practical experience in the manufacture of construction equipment, road machinery and other machinery. He is a member and past chairman of the Northwest chapter of the American Society of Metals.

A. D. Heffron, Jr., has been made district sales manager of the Chicago territory of the Babcock & Wilcox Tube Co., with headquarters in the company's Chicago office, 1502 Marquette Bldg.

L. E. Mustard has been appointed district manager of the branch office in Detroit of The Bristol Co., Waterbury, Conn. Born and raised in Michigan, Mr. Mustard attended the University of Michigan, and started his business career with the Westinghouse Electric & Manufacturing Co., East Pittsburgh. He joined the sales and service organization of The Bristol Co. in 1923, and in the years that followed was associated with the Pittsburgh, Denver, St. Louis and Dallas offices.

Incorporations

THE COAST LIME CO., Maywood, Cal. Engaged in business under the management of K. E. Gaskill.

EASTERN KENTUCKY STONE CO., Whitesburg, Ky. Incorporated by L. M. Hart and "Sandy" Adams.

MARIBEL GRAVEL, INC., Denmark, Wis. Capital $50,000. Incorporated by W. W. Bruss, H. A. Bruss and E. Shuster.

O'TOOLE STONE CO., Maplewood, Mo. Incorporated by Mae O'Toole of Clayton, Mo., and Nell M. Nichols of St. Louis.

THE MILLS ROCK CO., INC., Miami, Fla. Chartered by A. C. Franks and F. M. Phillips.

SUPERIOR MARBLE & GRANITE QUARRIES, INC., Dallas, Tex. Incorporated by Fred Elder and Bert Kahn.

Foreign Developments

Magnesia Content to 8 Per Cent. Permissible in Cement

From previous investigations it had been indicated that apparently the content of magnesia in Portland cement could amount to as much as 8 per cent. without producing the danger of unsoundness. To amplify these investigations five industrial raw materials—limestone, dolomite, shale, white quartzite and gravel cinder—were mixed with one another in different proportions to yield three kinds of clinker with a magnesia content of 3 per cent., 5 per cent. and 8 per cent. with the same hydraulic, silicate and iron moduli. The raw mix was driven through a 10,000-mesh sq. cm. screen, formed into small briquettes and then burned two hours in a gas-fired muffle kiln at 1,360 deg. C. The clinker had the following composition:

Clinker	SiO_2 (*per cent.*)	Al_2O_3 (*per cent.*)	Fe_2O_3 (*per cent.*)	CaO (*per cent.*)	CaO (free) (*per cent.*)	MgO (*per cent.*)
No. 1	22.45	5.00	3.48	66.02	(0.34)	2.85
No. 2	21.76	4.96	3.38	64.31	(0.31)	5.04
No. 3	21.05	4.70	3.13	62.50	(0.31)	8.19

	Hydraulic Modulus	Silicate Modulus	Iron Modulus			
No. 1	2.13	2.65	1.44	.....	.....	.....
No. 2	2.14	2.61	1.47	.....	.....	.....
No. 3	2.16	2.65	1.50	.....	.....	.....

The clinker was ground with 3 per cent. of gypsum and the compressive strength determined in specimens (1:3 mortar) 2 cm. in diameter and 3 cm. high. The strength values so determined were compared with results of similar specimens which after 28 days water storage were subjected 6 hours in an Autoclave to steam at 140 deg. C. The strength tests gave the following results:

Clinker	Residue on 4,900 mesh sq. cm. (*per cent.*)	Residue on 10,000 mesh sq. cm. (*per cent.*)	Gauging Water (*per cent.*)	Strength in kg. per sq. cm. after 3 Days	7 Days	28 Days	In the Autoclave
No. 1	1.5	12.6	53	53	126	200	213
No. 2	1.6	13.0	51	62	127	192	233
No. 3	1.4	14.3	54	47	110	170	177

From the results it was concluded that magnesium oxide in the amounts used here is not injurious, and indeed in a quantity up to 5 per cent. appears even to have an advantageous effect.—Seiji Kondo and Sadatsugu Wade in *Journal of the Japanese Ceramic Association*, December, 1935, No. 5-6, pages 6-9; *Toniudustrie-Zeitung*, 60: 170, No. 13, Feb. 13, 1936.

Influence of the Calcining Process on Burned Lime

Experiments and observations on the calcining of lime on ring kilns show that the conditions of calcination are of such importance in the production of lime that it is sometimes possible to obtain a product with practically the same properties, especially as concerns slaking energy and yield, from limestones of different sorts. Most sensitive to the conditions and temperature of burning is the mortar strength.

Limestones with high lime content yield a lighter slaking product on "sharp" burning than at lower temperatures. They are as a rule more plastic than the product of limestone low in lime content, but their strength is ordinarily less. Products of high-calcium stones are less influenced by the conditions of burning and the burning temperature than the products of stone lower in lime.

Coarse-grained limestones yield lighter slaking products if they are high in calcium; on the contrary, the fine-grained varieties yield lighter color on slaking if they are lower in calcium. Coarse-grained varieties of limestone must be more sharply burned to obtain the same slaking time as fine-grained varieties of equivalent chemical composition. Coarse-grained limestones yield limes of lower yield and lower strength than the fine-grained varieties.

Samples of lime from the same stone, at the same temperature, at the same point in the kiln, burned in the same manner, can be different in color, but be practically the same as regards time of slaking, yield and strength, as well as chemical composition. On the other hand, samples from the same stone, burned in the same manner but in two different ring kilns, can show similar behavior on slaking but different strengths and different chemical compositions.

It is possible to reduce considerably the residue of lime hard to slake by appropriate control of the burning. This is particularly the case when dealing with varieties of limestone which have been stratified by means of impurities.

In general a lower temperature, to a certain limit, is connected with higher yield and a determined optimum temperature with the highest strength. There appears to be no connection between yield and mortar strength.

The quality of ring-kiln lime even with the same raw material can be subject to great variations. According to the position of the material in the burning passage variations in the slaking power and yield up to about 30 per cent. and variations of strength up to 100 per cent. are possible.—Dr. Rudolf Barta in *Toniudustrie-Zeitung* 60:30, 41-42, Nos. 3, 4, Jan. 9 and 13, 1936.

Test for Distinguishing of Cement and Hydraulic Lime

The distinction between hydraulic limes and cements is sometimes hard to make, yet is sometimes of considerable importance. The author proposes a method based on loss on ignition (a) as such, and (b) after the lime or cement has been "artificially humidified" by vigorous shaking with water. Lime, except fresh unslaked lime, will already contain a large amount of water and will not take on much additional, while a much larger amount of water will be taken up by a cement. The ratio b/a (loss on ignition in each of the cases above specified) will be little more than 1 in case of a lime, considerably more in case of a cement. In a tabulation of 36 known materials, both limes and cements of a number of classifications and kinds, this result is shown neatly, all known limes being well below 1.50, all known cements well above 1.50 in the b/a ratio.—G. Baire in *Revue des Materiax de Construction et de Traveaux Publics*, No. 317, February, 1936, pages 25-27.

Effect of Salt Solutions on Set and Strength of Cement

Through the addition of appropriate salt solutions it is possible to influence the setting time and the initial hardening of cements within wide limits. While sulphates bring about a retardation and consequently make the cement especially suitable for the construction of dams, concrete and crushed-stone highways and other purposes, chlorides, and especially calcium chloride, reduce the setting time and increase the initial hardening in the first hours so greatly that the cements harden more rapidly than alumina cement.

As the final hardening is not unfavorably affected by chlorides, salt solutions accordingly present a means for the production of rapid hardening concrete. It appears advisable not to work with salt solutions when there is reinforcing, for as is known the presence of salts always accelerates rusting, even when the salts are neutral. Two years ago experiments on rust-proofing of reinforced concrete beams, with and without salt solutions, were begun by the author; the test pieces are to be tested soon and the results reported.—Dr. R. Grün in *Zement* 25:1-6, No. 1, Jan. 2, 1936.

Book Reviews

THE PNEUMONOKONIOSES (SILICOSIS) LITERATURE AND LAWS OF 1934, *by G. G. Davis, M.D., Ella M. Salmonsen, and J. L. Earlywine. Published by the Chicago Medical Press, 302 S. Canal St., Chicago, Ill. 490 p. Price $7.50.*

With millions of dollars being sought annually through the courts of this country as damages, either real or fancied, for silicosis contracted by workers in rock dust, this work should be read and be available in the reference library of the executive in the nonmetallic-minerals industry. Its references are gathered from the literature of the world; they begin with Agricola's *De re metallica* in 1556 A.D., and end—for the purposes of this volume—with the last published reference in December, 1933. Its compilers have been thorough and painstaking and believe no important reference regarding the disease has been omitted.

The work is made up of two parts, (I) the Abstracts and (II) the Laws. The former is followed by a bibliography and an authors' and subject index.

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THE DETERMINATION AND CONTROL OF INDUSTRIAL DUST, *by J. J. Bloomfield and J. M. Dallavalle, Prepared by the Surgeon General of the United States and published as Bulletin No. 217, U. S. Treasury Dept., Public Health Service, Washington, D. C. 167 p. Price 15c.*

The book departs from the technical and is quite understandable to the layman. It describes the methods and instruments used in conducting dust studies in industry, the manner of interpreting the results of such studies and their practical application to industrial problems, especially those phases dealing with the control of the dust hazard.

The material is based largely on the practical experience gained by the authors in engineering studies of the dust problem in numerous industries in the United States.

The value of the text has been augmented by the inclusion of 39 tables and 77 illustrations.

. . . . Traffic News and Comment . . . . .

Recent I. C. C. Decisions

Agricultural Limestone—Reparation has been awarded on finding that the rate charged on agricultural limestone from Bluffton, Ind., to certain points in Illinois on shipments moving between March 14 and April 17, 1934, was unreasonable to the extent it exceeded $1.11 a net ton.

Crushed Stone—In the Fifth Supplemental Report in the matter of switching rates in the Chicago Switching District, the prior findings in order have been modified to permit the Illinois Central R. R. to establish a rate on crushed stone c.l. minimum weight marked capacity of the car but not less than 100,000 lb. from quarries on its line at Hillside and Thornton in the Chicago switching district to South Water St., of 35c a net ton. The petitioner, the Illinois Central, asked permission to establish this rate in order to compete for the hauling of crushed stone for P.W.A. Projects in the vicinity of South Water St. One of the companies having a contract to furnish the stone for these projects stated that unless the 35c rate was established, the stone would move by water. The petition was opposed by other stone producers who claimed that there was no water competition in existence but the Commission found that the material would move by water or by truck and water and that the 35c rate on the high minimum would be compensatory. I. C. C. Docket No. 19,610, switching rates in the Chicago Switching District.

Ground Limestone—In response to Fourth Section applications Nos. 15,747, 15,780, 15,895, 15,917 and 16,075, the Commission has authorized railroads in official territory to establish rates equal to the lowest that may be made over any line or route on the basis prescribed in American Lime & Stone Co. *v.* Pennsylvania, 201 I. C. C. 467, without observing the long- and short-haul clause of Section Four, to districts in trunk line territory and in the eastern part of central territory on ground limestone and related articles from producing points in trunk line and New England territory. Relief is also granted on the movement of crushed stone from Lime Crest, N. J., and on ground marl from producing points in West Virginia and Maryland to destinations in central territory and Wisconsin, Zone C, and on ground or pulverized limestone and stone dust from producing points in trunk line territory to destinations in central territory and Wisconsin, Zone C, and to establish rates on ground and pulverized limestone from producing points in trunk line and New England territory to destinations in New England territory and rates on broken and crushed limestone from producing points in Vermont, Massachusetts, Connecticut, Maine and New York to destinations in New England territory. This authorization is subject to the usual 33⅓, 50 and 70 per cent. circuity limitations. I. C. C. F. S. O. No. 12,287.

The Commission has awarded reparation on finding that the rate of $2.60 a net ton charged on ground limestone from Thomasville, Pennsylvania, to Millville, N. J., on shipments moving between January 3, 1933, and December 10, 1934, was unreasonable to the extent it exceeded $2.05 plus the authorized emergency charge on a c.l. minimum weight of 60,000 lb. I. C. C. Docket No. 27,042, Whitall Tatum Co. *v.* Western Maryland, *et al.*

Pulverized Limestone—Reparation has been awarded on finding that the rate of $2.60 a net ton charged on shipments of ground or pulverized limestone moving from Thomasville, Pa., to Bridegton, N. J., between March 3, 1933, and December 3, 1934, was unreasonable to the extent it exceeded $2.45 on 40 shipments and $2.05 on 33 shipments. I. C. C. Docket No. 26,990, Owens Illinois Glass Co. *v.* Central of N. J., *et al.*

New Complaints Filed

Sand—The rates of molding sand in box-cars from Delhi, Milan and Huron, O., Elnora and Mechanicsville, N. Y., and on core sand in open-top and box-car equipment from Juniata (Mayville), Mich., to Kendallville, Ind., have been attacked under Section One and reparation is sought in a complaint filed by L. V. Brandt, Practitioner, 328 S. Jefferson St., Chicago, Ill., in I. C. C. Docket No. 27,345, Newnam Foundry Co., Kendallville, Ind., and Ohio Big Four, *et al.*

Reparation is sought and unreasonable rates alleged on sand from Dorchester, Cedarville, Hayville and Lumberton, N. J., and Elnora and Ushers, N. Y., to Dexter, Me., in a complaint filed by Abner Pollack, Practitioner, 1148 Manor Avenue, New York, N. Y., in I. C. C. Docket No. 27,346, Fay & Scott, Dexter, Me., *v.* Maine Central, *et al.* Alleging violation of Sections One, Two and Three, new rates are sought on sand from Michigan City, Ind., to destinations in Illinois, St. Louis, Mo., Kenosha, Racine, Beloit and Milwaukee, Wis., West Newton, Newcastle, Washington, and Pittsburgh, Pa., and Wheeling, W. Va. Undue preference is alleged for shippers at Gary, Miller and Willow Creek, Ind., and points in the Chicago Switching District. The complaint is filed by A. Ohlemacher, C. B. Ackerman and F. B. McElroy, 608 South Dearborn St., Chicago, Ill., in I. C. C. Docket No. 27,348, Producers' Core Sand Corp., Michigan City, Ind., *v.* Michigan Central.

The rates on sand from Millville, Manumuskin and Clayville, N. J., and Blossvale, N. Y., to Bridgeport, Connecticut, are alleged unreasonable and reparation is requested in a complaint filed by Leo Tessler, Practitioner, 1148 Manor Avenue, New York, N. Y., in I. C. C. Docket No. 27,358, Bullard Co., Bridgeport, Conn., *v.* N. Y. C., *et al.*

Reparation is sought on an allegation of unreasonable rates on glass sand from Hancock, W. Va., to Maspeth, N. Y., in a complaint filed by L. H. Rubin, Practitioner, 150 Nassau St., New York, N. Y., in I. C. C. Docket No. 27,364, Gleason Tiebout Glass Co., Maspeth, N. Y., *v.* Long Island, *et al.*

Traffic News

Traffic League Meeting—At the March 31 meeting of the National Industrial Traffic League, Commissioner Meyer opposed any law compelling a reorganization or increasing the size of the Interstate Commerce Commission. The League voted to go on record as opposing any extension of the emergency charges beyond the present expiration date of June 30, 1936. A resolution was adopted favoring the adoption of a uniform Bill of Lading for motor carriers. The legislative committee recommended that the League modify its position against continuing the office of Federal Coördinator to the extent that they would not oppose continuation for one more year but this recommendation was not accepted and the League voted to favor the termination of the office in June of this year. The recommendation that the Wheeler-Crosser Rail Labor Protection bills now before Congress be opposed was approved by the League. The League also voted to oppose the Wheeler Anti-Basing Point bill now before the Senate which would tend to destroy the present method of pricing steel, gypsum products, lime products and other commodities.

Emergency Surcharges—Included in the twenty-six persons who testified against the continuation of the emergency surcharges at the hearing in Ex Parte 115 in Chicago April 7 was B. A. Word, Traffic Manager of the Kentucky Rock Asphalt Co., of Louisville, Ky. He related how the emergency charges had disrupted the relative rates on sand, gravel and other road materials in southern territory. W. M. Fitzgerald, of Chicago, traffic manager of the Gypsum Assn., speaking for the gypsum industry, said that the emergency was over and that the emergency charges should therefore be allowed to expire and that, if the Commission found that the carriers still needed the additional revenue, it should be arranged for by increasing the basic rates and not by something special added to the basic rates.

E. O. Schneider, sales manager of the Ottawa Silica Co., representing a number of sand producers, said that, while there was an increase in the sand business in 1935, the increase would have been more marked had it not been for the emergency-rate assessment. He claimed that the surcharge had disturbed carefully affixed freight rates on sand and that if the Commission decided to continue the emergency charges they should be assessed on the basis of so much per ton instead of in percentages. To give some idea of the amount of the surcharge, the witness for Armour & Co. stated that his company was paying $1,250,000 a year in surcharges.

Motor-Vehicle Transportation—More than 30,000 motor tariffs were filed with the Commission to become effective April 1. Quite a number did not conform to the rules laid down by the Commission for filing tariffs and were returned for correction, but as the corrected tariffs were received by the Commission, they were stamped March 31. Most of the class rates published by motor carriers are the same as the rail class rates with the exception that they do not carry any emergency charge.

The Union Pacific, the Burlington, and the Chicago and Northwestern have asked for authority to acquire control of the Union Transfer Co. through stock ownership for $150,000 in Docket No. BMC F-16. The purpose is to set up a rail-truck system that will reach into territories which are not now served by these three rail lines. It is expected to develop this system at an ultimate cost of $6,000,000 and that other rail carriers will later join in the ownership of the transfer company.

The proposed acquisition of the Chicago-Cincinnati Motor Freight Lines by a subsidiary of the Pennsylvania R. R. Co. is opposed in the proposed report of J. Edward Davey, Chief of the Section of Finance in the Bureau of Motor Carriers in Docket No. BMC F-1. Davey states that the applicant has not supported the proposal by material facts and evidence sufficient to justify an order authorizing the purchase.

A petition has been filed with the Commission by the American Trucking Assn., Inc., and the Brooks Transportation Co. by asking for a nation-wide investigation and cancellation of railroad pick-up and delivery tariffs. The petitioners claim that the rail tariffs offering this service are in violation of the Motor Carrier Act.

Manufacturers' Announcements

Lieb-Jackson, Inc., 337 S. High St., Columbus, O., and F. B. Schwartz, 1019 S. Washington Ave., Minneapolis, Minn., have been appointed agents by the Pennsylvania Pump & Compressor Co. of Easton, Pa.

The Bin-Dicator Co., 14615 E. Jefferson Ave., Detroit, Mich., has succeeded the Ripley Mfg. Co., Wayne, Mich., and will continue manufacturing the automatic bin-level indication and control equipment manufactured by the old concern.

New Machinery . . . and Supplies

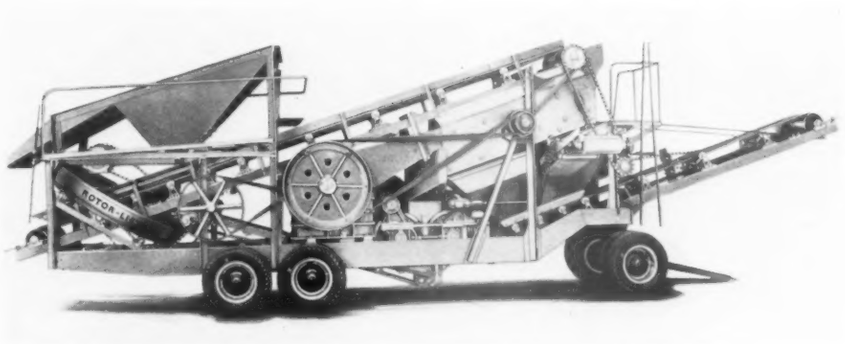
Rotary Device Eliminates Need for Bucket Elevator

A new portable crushing and screening plant incorporating the new Rotor-Lift, which does away with a bucket elevator and makes a short wheelbase possible, has been announced by Diamond Iron Works, Minneapolis, Minn.

The Rotor-Lift, as the illustration shows, revolves slowly, carrying the material from the crushers up and over the main plant conveyor where it is automatically discharged by gravity.

The plant is equipped with a 10-in. by 36-in. Diamond roller-bearing crusher, a secondary 30-in. by 20-in. crusher of the same type, and a 4-ft. by 8-ft. vibrating screen hung in live rubber and equipped with 2½ decks. A unique arrangement of the screening decks assures proper sizing with unusually large capacity.

All bearings throughout the plant are full anti-friction. Power consumption is extremely low and operating the plant at full speed requires only 10 hp.



Portable plant employing the "Rotor-Lift" which does away with bucket elevator.

Complete Mobility Feature of New Walking Drag-Line

The Page Engineering Co., Chicago, Ill., recently announced a new type walking drag-line machine built in sizes ranging from 2½ to 20 cu. yd. and known as the Series 600. The Series 600 machines are supplementary to other walking, crawler, and truck-type drag-lines which the Page concern has been manufacturing for a number of years.

The new drag-lines are of the two-shoe type. By means of a direct drive from the engine to the cranks attached to the side-mounted shoes, movements are made, lifting and sliding the machine for a step of six feet. Steps are automatic at the rate of three per minute. The complete walking mechanism is based on a simple, positive, crank-action principle that is said to be foolproof and offers no limitations as to the size and weight machine it will handle. When the machine is digging, the shoes are held well above the ground by an automatically-set brake.

Advantages claimed for the Series 600 Page walker are its complete mobility in any direction, the economical, medium-speed, horizontal Page Diesel engine, the large base or "tub" which gives ample footing for working even on the softest ground, the high fairlead which saves wear on cable, the welded alloy steel boom, the unusually high swinging hoist and load speeds, and the ability to maintain high yardage 24 hr. per day, day after day, and month after month.

The walking drag-line showing scraper and the long boom.

High-Speed Transmission Belting Fabric Developed

The Thermoid Rubber Co., Trenton, N. J., announces the development of a new belting called Plytex for high-speed transmission over small pulleys.

One of the outstanding virtues of this new belting is its extreme flexibility, assuring positive transmission, no matter how great the operating speed or how small the pulley application. It has been approved for use in many industrial fields, and is especially adaptable for use on drives for motor fans, centrifugal pumps, etc.

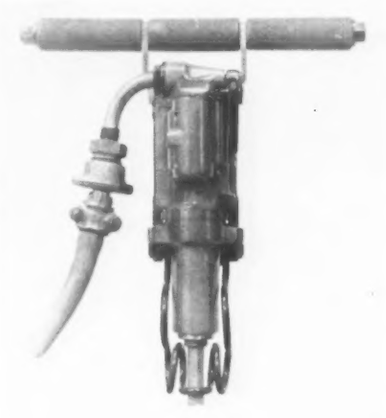
It is made of a specially constructed light weight silver duck fabric, with a high-test skim friction between plies, and is furnished in 4, 5, 6 and 7 plies from one to eight inches.

New Auger Drill Especially Adapted to Soft Drilling

Due to the inability of most rock drills to give satisfactory performance when drilling soft material, the Sullivan Machinery Co. has designed the H-2, a 45-lb. auger drill. However, by means of a simple change it can be made into a machine which will give good performance in hard rock.

Yet, the H-2 was purposely designed for auger drilling and is, therefore, especially adapted for use in drilling soft iron ore, anthracite, gypsum, limestone, slate, shale, frozen ground, or any heavy, sticky formation, because of its tremendous stalling torque resulting in an extra strong rotation. Stalling, consequently, is greatly minimized, and the result is a superior auger drill.

Some of the features are: (1) superior drilling speed in auger conditions; (2) ease of operation; and (3) surprisingly low upkeep cost.

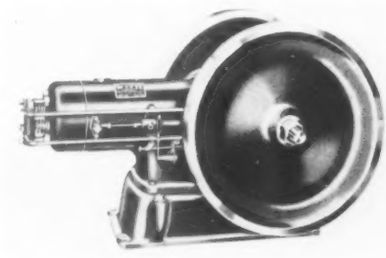


Auger drill for use in soft or hard material.

Small Diesel-Engine Units Provide Power at Low Cost

Power at one-eighth the usual cost is claimed for a line of small Diesel engines recently introduced by the Witte Engine Works, Kansas City, Mo.

These small Diesels consume ½ pint of fuel (costing 5c. to 8c. per gal.) per hp.-hr. and are supplied in two models of 5 hp. and 10 hp. each. All cast parts subject to wear and strain are of special nickel-iron. Fuel consumption is regulated by a governor in proportion to the load, without starting devices such as wicks, hot tubes or other preheating methods.



Diesel engine supplied in 5- and 10-hp. models.

Small Diesel power plants of 3 to 7½ kw. at 110 and 220 v. are also being marketed. Output is either alternating or direct current.

Sand Pump Has Only Four Parts Subject to Wear

The new Type K sand pump of Morris Machine Works, Baldwinsville, N. Y., is unique in its simplicity of construction and resulting low cost without sacrifice of efficiency or durability. These units represent the most advanced design and construction for dependable, trouble-free operation with long life.

This pump has only four parts subject to wear: the shell, suction disk, impeller and shaft. It has no hub disk, liner, suction-throat sealing ring, shaft sleeve, or other parts which would require adjustments to maintain initial efficiency or ultimate replacement due to wear. Its remarkably high efficiency, which is at least 10 per cent. greater than that of older types of sand pumps, is provided by the design of its waterways, based on 72 years of experience of the Morris engineers in specializing on centrifugal pumps for handling abrasive materials.

In addition to low first cost and minimum expense for renewals, a further advantage of the simple design of Morris Type K pumps is that their construction permits the use of any alloy, whether machineable or not, for all parts subject to wear.

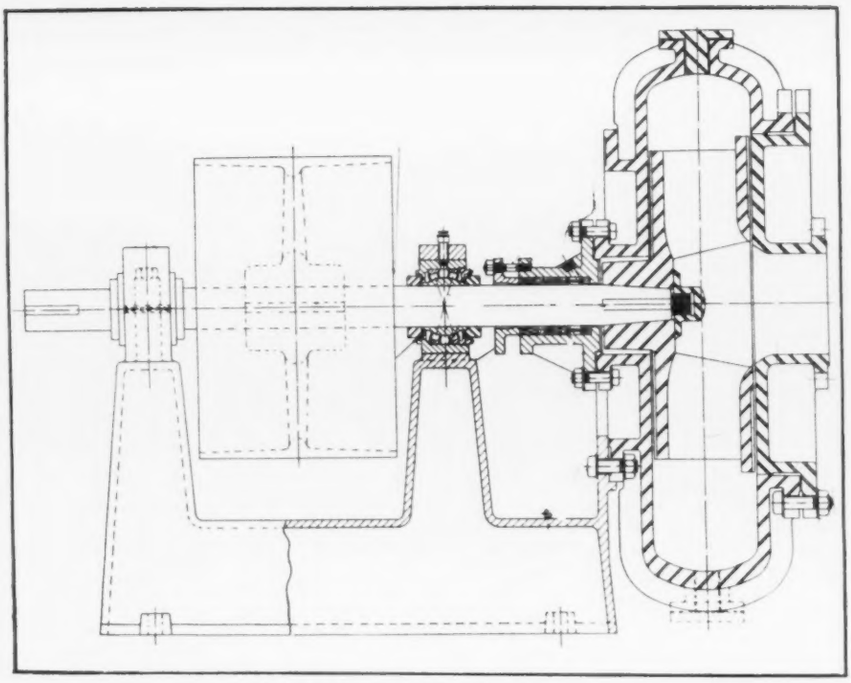
The casing or shell of these pumps is of volute design, with disk on the suction side only. The proportions of the shell have been carefully determined so that the sections subject to greatest wear have maximum thickness of metal. As a result, the shell far outlasts other designs; and when it must finally be discarded after long service, it will represent a minimum of scrap.

The circular mounting of the shell on the frame provides unusually substantial support, and the frame also carries the bearing, thereby assuring a rigid and compact unit which will withstand severe service without vibration or pounding.

The suction disk is fastened to the shell with bolts which fit within slots, so that the bolts require only loosening for removal to inspect the interior of the pump. A plug is provided at the bottom of the shell to permit complete draining in installations at locations where there may be possibility of freezing.

The impeller is of the enclosed type for complete guidance of the water and material passing through the pump and resulting maximum efficiency. The impeller vanes are proportioned so that they are thickest where subject to greatest abrasive action of the material passing through the pump, and the impeller will therefore give exceptionally long service before requiring replacement.

The special design of the impeller develops and maintains high efficiency without requiring mechanical seal at the suction throat. The suction shroud of the impeller is extended down to the same size as the suction opening, and this shroud is also equipped with external vanes. The action of these vanes is to build up pressure equal to that of the main impeller vanes in the space between the suction shroud and the suction disk, and to produce neutral pressure at the suction entrance of the impeller so that there is a minimum of eddy loss and wear due to circulation of material around the suction disk or suction entrance.

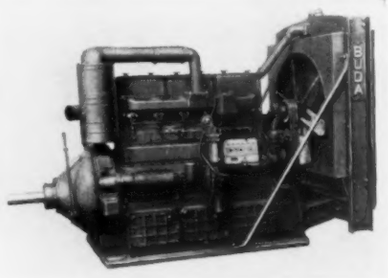


Sectional diagram of Type K sand pump.

Auxiliary Air Chamber in New Model Diesel Engine

The Buda-Lanova Diesel engine, manufactured by the Buda Co., Harvey, Ill., employs an unusual type of cylinder head which results in "soft combustion" and which is attained through increased turbulence and controlled combustion. This is accomplished principally through the use of an auxiliary air chamber, which, because of its function, is called the "energy cell."

In the Buda-Lanova Diesel, the rate of pressure rise is well within the limits of gasoline-engine practice; maximum pressures are not over 625 lb. per sq. in. The compression ratio is also comparable to



Controlled combustion is obtained in this new Diesel engine.

that of a gasoline engine—being between 12.5 to 1 and 13.2 to 1. The unusual and controlled turbulence develops a high workable mean effective pressure, which, in most Diesels, can be obtained only by high combustion pressure.

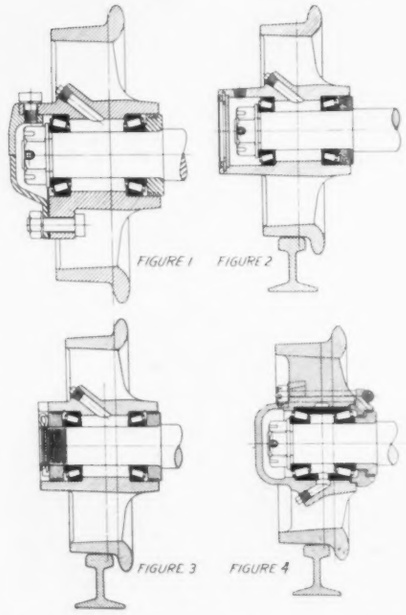
The Buda-Lanova Model 6-LD-909, illustrated, is the most recent addition to the Buda line of industrial engines. It is a 6-cyl., 4-cycle, solid injection engine with a 5¼ in. bore and 7 in. stroke, 909 cu. in. displacement, and develops 178 h.p. at 1500 r.p.m., and 156 h.p. at 1200 r.p.m.

Because of lower specific weight, compactness, smoothness and flexibility, cleaner combustion and lower fuel costs, the Buda-Lanova 909 is ideal for generator and stationary service, as well as portable use on shovels, cranes, locomotives, hoists, pumps, drilling rigs, crushers, compressors, pavers, rollers and other construction equipment.

Roller-Bearing Mountings for Mine-Car Wheels

An accompanying drawing from The Timken Roller Bearing Co. shows clearly how the different types of wheels are mounted on mine-car axles. One axle shows the standard two-bearing mounting with the annular groove closure (Fig. 1) which has given general satisfaction in service. Another view shows the latest Timken labyrinth closure (Fig. 2) as used with the standard Timken bearing mounting. The conventional mounting, demonstrating how the new Timken combination nut and closure is applied, giving the protection of annular groove closures to the outer end of the journal in addition to functioning as an adjusting nut for the two Timken bearings which constitute the wheel mounting, is shown in Fig. 3.

The new Timken shrunk-on dust collar (Fig. 4) has been modified to provide a labyrinth seal. With this double-cup mounting the bearing remains in place on the axle as a complete unit when wheels are removed for replacement or inspection, the bearing adjustment remaining undisturbed.

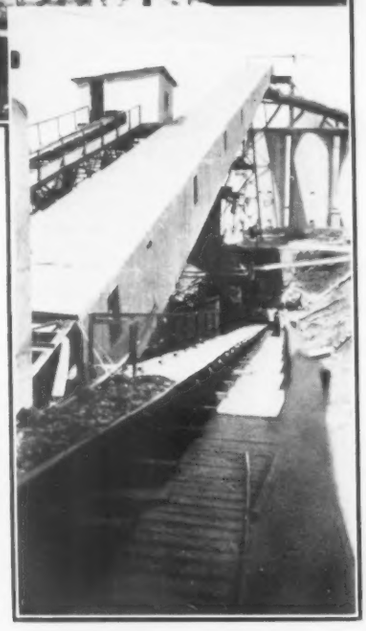


Sectional views of roller-bearing mine-car wheels.

REPUBLIC

Conveyor Belting

BACKED BY TECHNICAL SERVICE



WHAT SPEED?

For satisfactory performance, there is a definite relationship between the width of the belt and the speed at which it should be operated. Usually, the wider the belt the greater the permissible speed for a given kind of material. Heavy, sharp or abrasive materials should be handled at lower speeds to prevent shifting of the load and to minimize wear.

★ The proper grade of conveyor or elevator belting for any individual use depends upon the particular service to be performed.

In view of the variety of materials handled and the diversity of applications, thorough knowledge and experience are essential for making dependable recommendations.

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A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

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Abrasion Resisting Steel
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Aftercoolers (Air)
Worthington Pump & Machy. Corp.

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Hetherington & Berner, Inc.

Agitating Ladders (Dredge)
*Eagle Iron Works

Agitators, Thickness and Slurry Mixers
*Hardinge Co.
*Traylor Engr. & Mfg. Co.

Air Compressors (Portable)
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Sullivan Machy. Co.
*Traylor Engr. & Mfg. Co.
Worthington Pump & Machy. Corp.

Air Compressors (Stationary)
*Chicago Pneumatic Tool Co.
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*Sullivan Machy. Co.
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*Western Precipitation Co.

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Worthington Pump & Machy. Corp.

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*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
*Raymond Bros. Impact Pulv. Co.
*Williams Pat. Crusher & Pulv. Co.

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Taylor-Wharton Iron & Steel Co.
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*Jeffrey Mfg. Co.
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Automatic Feeders
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*Hardinge Co.
*Jeffrey Mfg. Co.
*Link Belt Co.

Babbitt Metal
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Backfillers
*Austin-Western Road Machy. Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
*Lima Locomotive Works, Inc.

Balls (Grinding)
Carnegie-Illinois Steel Corp.
*Hardinge Co.
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Taylor-Wharton Iron & Steel Co.
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Balls (Tube-Mill, etc.)
*Allis-Chalmers Mfg. Co.
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*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
Straub Mfg. Co.

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*Link-Belt Co.
*Robins Conveying Belt Co.

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Haiss Mfg. Co., Geo.
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Republic Rubber Co.
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Republic Rubber Co.

Belts (Fan)
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Republic Rubber Co.

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Bin-Dictator Co.

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Bins (Cast Iron)
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*Sauerman Bros., Inc.

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Bodies (Motor Truck)
Hug Co.

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Pennsylvania Drilling Co.

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*Tyler Co., W. S.

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Buckets (Clamshell, Orange-Peel, Etc.)
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*Harnischfeger Corp.
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*Link-Belt Co.

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*Bucyrus-Erie Co.
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*Page Engr. Co.
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*Sauerman Bros., Inc.

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Calcium Chloride Assn.

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*Link-Belt Co.

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*Link-Belt Co.

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Manganese Steel Forge Co.

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McLanahan and Stone Corp.
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*Hardinge Co.
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*Allis-Chalmers Mfg. Co.
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*Chicago Pneumatic Tool Co.
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*Koehring Co.

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Smith Engr. Works

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*Jeffrey Mfg. Co.
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Conveyors (Ready-Mixed Concrete)
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*Link-Belt Co.
*Robins Conveying Belt Co.

Coolers (Clinker)
*Allis-Chalmers Mfg. Co.

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Couplings (Flexible and Shaft)
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Couplings (Hose)
*Chicago Pneumatic Tool Co.

Cranes (Crawler and Locomotive)
*Austin-Western Road Machy. Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
Industrial Brownhoist Corp.
*Lima Locomotive Works, Inc.
*Koehring Co.
*Link-Belt Co.
Thew Shovel Co.
Universal Crane Co.

Cranes (Overhead)
*Harnischfeger Corp.
Industrial Brownhoist Corp.

Crusher Parts
American Manganese Steel Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
Taylor-Wharton Iron & Steel Co.

Crushers (Cone)
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Crushers (Hammer)
*Allis-Chalmers Mfg. Co.
*Austin-Western Road Machy. Co.
Bonnot Co.
Carnegie-Illinois Steel Corp.
*Dixie Machy. Mfg. Co.
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*Jeffrey Mfg. Co.
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Straub Mfg. Co.
*Williams Pat. Crusher & Pulv. Co.

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Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.

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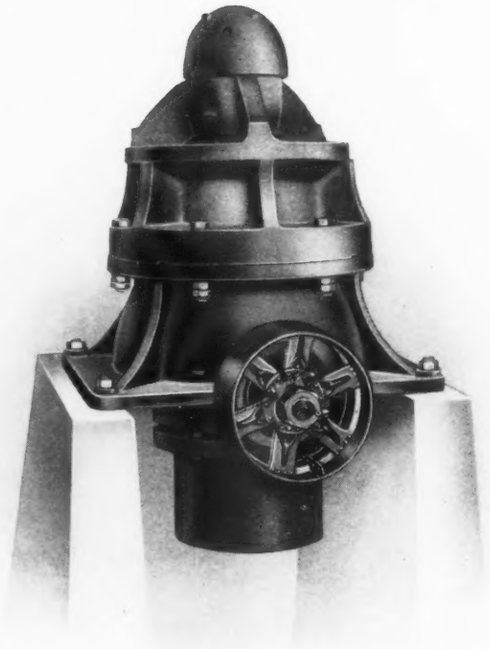
TRAYLOR



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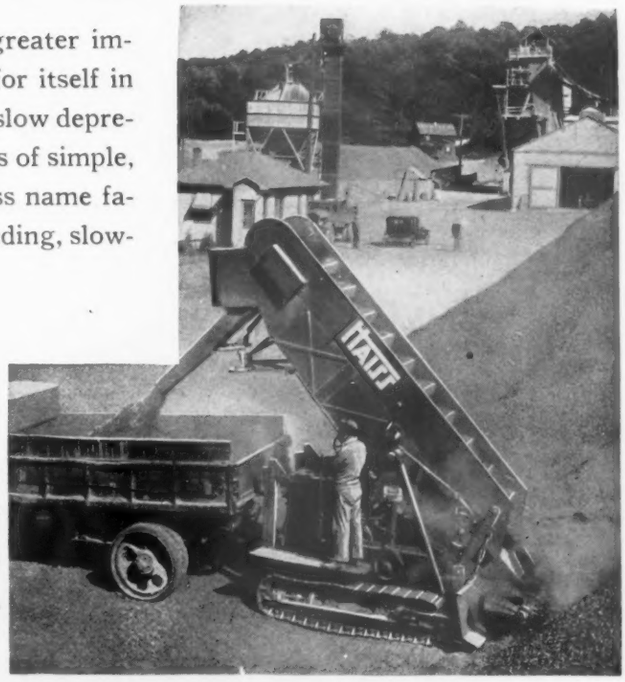

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Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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*Austin-Western Road Machy. Co.
Bonnot Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
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*Pioneer Gravel Equipment Mfg. Co.
*Robins Conveying Belt Co.
Straub Mfg. Co.
*Williams Pat. Crusher & Pulv. Co.

Crushers (Rotary)
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*Williams Pat. Crusher & Pulv. Co.

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*Allis-Chalmers Mfg. Co.
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*Kennedy-Van Saun Mfg. and Eng. Corp.
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McLanahan and Stone Corp.
New Holland Machine Co.
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Williams Pat. Crusher & Pulv. Co.

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Du Pont de Nemours & Co.

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Dipper Parts
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Taylor-Wharton Iron & Steel Co.

Dippers and Teeth (Power Shovel)
American Manganese Steel Co.
*Bucyrus-Erie Co.
*Koehring Co.
Taylor-Wharton Iron & Steel Co.

Dragline Cableway Excavators
Good Roads Machy. Corp.
*Link-Belt Co.
*Page Engr. Co.
*Sauerman Bros., Inc.

Dragline Excavators
*Austin-Western Road Machy. Co.
*Bucyrus-Erie Co.
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*Sullivan Machy. Co.
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*Chicago Pneumatic Tool Co.
Hoffman Bros. Drilling Co.
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*Chicago Pneumatic Tool Co.
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*Chicago Pneumatic Tool Co.
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*Jeffrey Mfg. Co.
*Sullivan Machy. Co.
Worthington Pump & Machy. Corp.

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Gardner-Denver Co.
*Sullivan Machy. Co.

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*Chicago Pneumatic Tool Co.
*Sullivan Machy. Co.

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*Allis-Chalmers Mfg. Co.
Worthington Pump & Machy. Corp.

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*Allis-Chalmers Mfg. Co.
Bonnot Co.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mch. Co.
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

Dust Arresters
*American Air Filter Co.
*Western Precipitation Co.

Dust Collecting Systems
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
*American Air Filter Co.
*Raymond Bros. Impact Pulv. Co.
*Western Precipitation Co.

Dust Conveying Systems
*Allen-Sherman-Hoff Co.
*American Air Filter Co.
*Western Precipitation Co.

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*Allen-Sherman-Hoff Co.

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*Allis-Chalmers Mfg. Co.

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Stulz-Sickles Co.

Elevator Belting (See Belting)

Elevators (See Conveyors and Elevators)

Eliminators (Soft Stone) (See Soft Stone Eliminators)

Engineers
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Bonnot Co.
Hetherington & Berner, Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.

Engine Generator Sets
See Generator Sets (Engine).

Engines (Diesel)
Buckeye Machine Co.
*Chicago Pneumatic Tool Co.
Cummins Engine Co.
Nordberg Mfg. Co.
*Page Engr. Co.
Worthington Pump & Machy. Corp.

Engines (Internal-Combustion)
Buckeye Machine Co.
*Chicago Pneumatic Tool Co.
Cummins Engine Co.
Nordberg Mfg. Co.
Worthington Pump & Machy. Corp.

Engines (Steam)
*Morris Machine Works
Nordberg Mfg. Co.

Excavating Machinery (See Shovels; Cranes; Buckets, etc.)

Excavators—Shallow Grading (Bucket Elevator Type)
Haiss Mfg. Co., Geo.

Explosives
Du Pont de Nemours & Co.

Fans (Exhaust)
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Feeders
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Bonnot Co.
Good Roads Machy. Corp.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
*Pioneer Gravel Equipment Mfg. Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Straub Mfg. Co.

Feed Water Heaters
Worthington Pump & Machy. Corp.

Floor Sweeping Systems (Hydro Vacuum)
*Allen-Sherman-Hoff Co.

Forges (Oil)
Gardner-Denver Co.

Fuses (Detonating)
Du Pont de Nemours & Co.
*Ensign-Bickford Co.

Gaskets
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.

Gasoline Engines (See Engines—Internal-Combustion)

Gates (Bin) (See Bin Gates)

Gates (Clamshell)
Haiss Mfg. Co., Geo.
*Link-Belt Co.

Gears (Herringbone)
*Jeffrey Mfg. Co.
*Link-Belt Co.

Gears and Pinions
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Gelatin (See Explosives)

Generators (See Motors and Generators)

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Grab Buckets (See Buckets—Clamshell, Orange-Peel, etc.)

Grating (Steel)
*Hendrick Mfg. Co.
Ryerson & Son, Joseph T.

Grinding Balls (See Balls, Grinding)

Grizzlies
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Eagle Iron Works
Good Roads Machy. Corp.
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mach. Co.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.

Guards (Wire)
Manganese Steel Forge Co.

Guns (Hydraulic)
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works

Hammer Mills (See Crushers—Hammer)

Hoists
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Harnischfeger Corp.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
*Pioneer Gravel Equipment Mfg. Co.
*Sauerman Bros., Inc.
Smith Engr. Works
*Sullivan Machy. Co.

Hoppers
*Hendrick Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

Hose (Air, Steam and Water)
*Chicago Pneumatic Tool Co.
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.
Worthington Pump & Machy. Corp.

Hose (Radiator-Engine Cooling)
Goodyear Tire & Rubber Co.
Republic Rubber Co.

Hose Couplings (See Couplings)

Hydraulic Guns (See Guns—Hydraulic)

Idlers
American Manganese Steel Co.
Good Roads Machy. Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Indicators (Bin)
Bin-Dicator Co.

Kilns and Coolers (Rotary)
*Allis-Chalmers Mfg. Co.
Bonnot Co.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Traylor Engr. & Mfg. Co.

Kilns (Vertical)
*Hardinge Co.

Lime-Handling Equipment
*Hardinge Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Raymond Bros Impact Pulv. Co.
*Robins Conveying Belt Co.

Lime and Hydrating Plants
*Hardinge Co.

Lime Kilns
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Linings (Ball- and Tube-Mill (See Mill Liners and Linings)

Loaders and Unloaders
*Bucyrus-Erie Co.
Good Roads Machy. Corp.
Haiss Mfg. Co., Geo.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Locomotives (Electric, Gas and Steam)
*Lima Locomotive Works

Locomotives (Trolley-Battery)
*Jeffrey Mfg. Co.

Magnetic Pulleys (See Pulleys, Magnetic)

Manganese Steel
American Manganese Steel Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.
Ryerson & Son, Joseph T.

Manganese Steel (Plates and Sheets)
American Manganese Steel Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.
Ryerson & Son, Joseph T.

Mechanical Rubber Goods
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.

Mill Liners and Linings
American Manganese Steel Co.
Carnegie-Illinois Steel Corp.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Mills (Grinding) (See also Crushers—Hammer)
*Allis-Chalmers Mfg. Co.
Bonnot Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mch. Co.
*Raymond Bros. Impact Pulv. Co.
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Williams Pat. Crusher & Pulv. Co.

Motors and Generators
*Allis-Chalmers Mfg. Co.
*Harnischfeger Corp.

Motors (Internal-Combustion) (See Engines—Internal-Combustion)

Motor Trucks
Chrysler Motors (Dodge Division)
Hug Co.

Nails
Ryerson & Son, Joseph T.

Netting (Locomotive Stack)
Tyler Co., W. S.

Nozzles (Gravel Washing)
*Deister Concentrator Co.

Nozzles (Hydraulic) (See Guns—Hydraulic)

Nozzles (Spray)
*Deister Concentrator Co.

Packings
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.

Paving Mixers
Jaeger Machine Co.
*Koehring Co.

Perforated Metal Plates
*Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
*Hendrick Mfg. Co.
Ryerson & Son, Joseph T.

Pipe, Dredge (Floating and Shore)
Taylor Forge & Pipe Works

Pipe Flanges
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works
Ryerson & Son, Joseph T.

*** See also information in the 1936 Pit and Quarry HANDBOOK.**

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Crush 36 in. Rock to 1¼ in. in One Operation

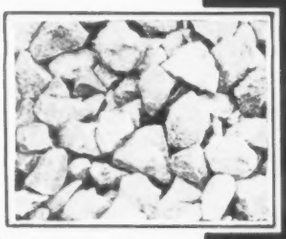
With One Williams Crusher—Saving in Investment of 50% to 75%

(A Size Crusher for every job)
(Capacities 3 to 300 tons per hour)

Power Shovel loaded rock reduced to commercial size in one operation with one Williams Crusher. Saves much sledging and avoids secondary blasting—Saves by use of smaller buildings, fewer foundations, conveyors, drives and motors. Write for literature.

CUTAWAY VIEW
of a Williams "Jumbo Junior" Crusher, Showing Hammers and Sizing Grates.

A Williams Crushed Product
(Actual Photo)
Note the cubular form of Product with no slivers and slabs.



Both samples taken from the same quarry

Ordinary Crushed Product
(Actual Photo)
Note slivers and slabs not crushed by a Williams crusher.

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NEW YORK, 15 Park Row

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Travel Speeds 1 or 20 M.P.H.

The time spent by a crane in traveling and switching is too often overlooked. For example: a crawler crane travels ½ to 1 mile per hour while some railroad cranes travel up to 20 miles per hour. And the switching ability of the two types is in about the same proportion. This does not mean that a railroad crane is better for every job—that depends on operating conditions. As builders of a complete line of both crawler and railroad cranes, we will give you an unbiased judgment as to which type will be most economical for your work.

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INDUSTRIAL BROWNHOIST

NEW YORK, PHILADELPHIA
CLEVELAND, CHICAGO

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Index to Advertisers on Page 96

Pipe Forms (Concrete)
Quinn Wire & Iron Works
Pipe Machines (Concrete)
Quinn Wire & Iron Works
Plants (Aggremeter) (See Aggremeter Plants)
Plug Valves (See Valves)
Pneumatic Drills (See Drills, Rock)
Portable Conveyors
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Portable Crushing and Screening Plants
*Austin-Western Road Machy. Co.
Good Roads Machy. Corp.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Pioneer Gravel Equipment Mfg. Co.
*Williams Pat. Crusher & Pulv. Co.
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*Raymond Bros. Impact Pulv. Co.
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*Austin-Western Road Machy. Co.
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*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
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*Allen-Sherman-Hoff Co.
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*Chicago Pneumatic Tool Co.
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Ryerson & Son, Joseph T.
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*Jeffrey Mfg. Co.
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*Pioneer Gravel Equipment Mfg. Co.
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Good Roads Machy. Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Pioneer Gravel Equipment Mfg. Co.
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*Austin-Western Road Machy. Co.
*Link-Belt Co.
*Pioneer Gravel Equipment Mfg. Co.
*Sauerman Bros., Inc.
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*Allis-Chalmers Mfg. Co.
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Carnegie-Illinois Steel Corp.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Eagle Iron Works
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*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
*Hardinge Co.
*Hendrick Mfg. Co.
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*Jeffrey Mfg. Co.
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*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
Simplicity Engr. Co.
Smith Engr. Works
Straub Mfg. Co.
Symons Bros. Development Co.
Taylor-Wharton Iron & Steel Co.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Screens (Vibrating or Shaking)
*Allis-Chalmers Mfg. Co.
*Austin-Western Road Machy. Co.
*Deister Concentrator Co.
*Deister Machine Co.
Good Roads Machy. Corp.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Nordberg Mfg. Co.
*Pioneer Gravel Equipment Mfg. Co.
*Productive Equip. Corp.
*Robins Conveying Belt Co.
Simplicity Engr. Co.
Smith Engr. Works
Straub Mfg. Co.
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*Tyler Co., W. S.
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*Eagle Iron Works
*Gruendler Crusher & Pulverizer Co.
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*Jeffrey Mfg. Co.
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*Austin-Western Road Machy. Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
Industrial Brownhoist Corp.
*Koehring Co.
*Lima Locomotive Wks., Inc.
*Link-Belt Co.
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Universal Crane Co.
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*Allis Chalmers Mfg. Co.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
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*Jeffrey Mfg. Co.
*Link-Belt Co.
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*Jeffrey Mfg. Co.
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Ryerson & Son, Joseph T.
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Ryerson & Son, Joseph T.
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*Jeffrey Mfg. Co.
*Kern Co., Fred T.
*Link-Belt Co.
*Sauerman Bros., Inc.
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*Hendrick Mfg. Co.
*Link-Belt Co.
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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Pioneer Gravel Equipment Mfg. Co.
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General Tire & Rubber Co.
Goodyear Tire & Rubber Co.
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*Roebling's Sons Co., John A.
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*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
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*Link-Belt Co.
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*Tyler Co., W. S.
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Le Tourneau, Inc., R. G.
Washers (Sand, Gravel and Stone)
*Allis-Chalmers Mfg. Co.
*Eagle Iron Works
Good Roads Machy. Corp.
Haiss Mfg. Co., Geo.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Mach. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
*Pioneer Gravel Equipment Mfg. Co.
Smith Engr. Works
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Welding and Cutting Equipment
*Harnischfeger Corp.
Ryerson & Son, Joseph T.
Stulz Sickles Co.
Welding Supplies
American Manganese Steel Co.
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.
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*Eagle Iron Works
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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
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*Roebling's Sons Co., John A.
Wire Cloth
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Cleveland Wire Cloth & Mfg. Co.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
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Wire Rope
*Hazard Wire Rope Co.
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*Page Engr. Co.
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*Roebling's Sons Co., John A.
Ryerson & Son, Joseph T.
Worm Gears (See Gears and Pinions)

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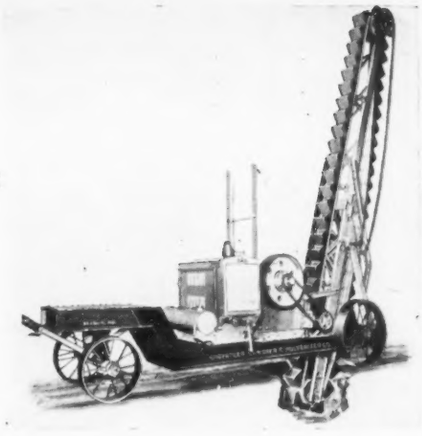

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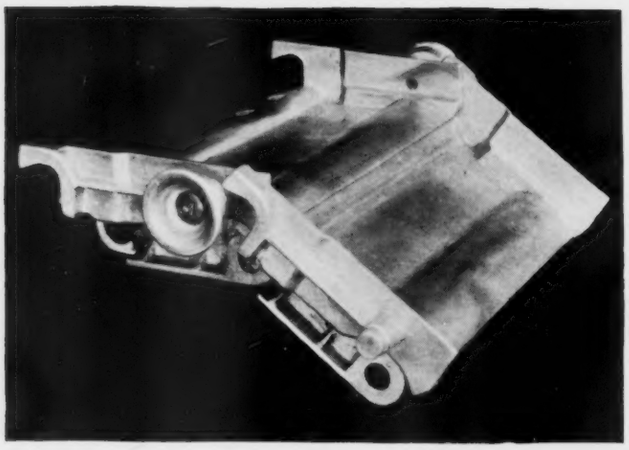

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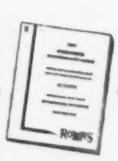
MATERIAL HANDLING ROBINS EQUIPMENT

Robins products are described in various bulletins. Send for those of interest to you.



Robins Conveying Belt Co.
15 Park Row, New York

Please send me Bulletin describing.....

Name .....

Firm .....

Address .....

City ..... *State*.....

Bringing gravel to the crusher in a hurry on a short haul with a Le Tourneau Bulldozer in Washington.

BUILT *for Day After Day* PERFORMANCE

Strength—the ability to take the battering shocks and strains of pit and quarry work—is an outstanding characteristic of all Le Tourneau equipment. This strength is achieved by the use of special high-tensile alloy steels—made to exacting Le Tourneau specifications—and electric arc welding—there are no castings, no rivets to work loose or shear off. As a result, Le Tourneau construction is stout and rigid, stands up, repairs are few and easily made, equipment life is prolonged, maintenance costs are extremely low, and big, hourly yardages are delivered steadily day after day.

Ask your "Caterpillar" tractor dealer what this ruggedly-built, job-proved equipment can do for you.

R. G. LE TOURNEAU INC.

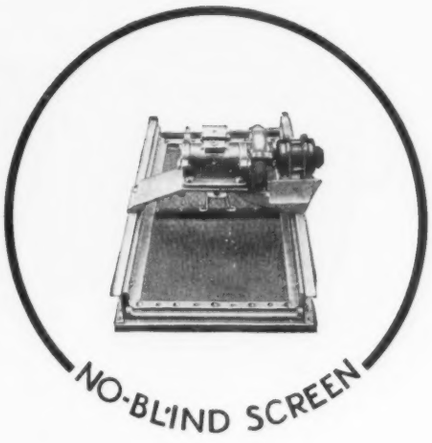
Peoria, Illinois **Stockton, California**

Cable Address: "Bobletorno"

Manufacturers of: Angledozers, Buggies, Bulldozers, Carryall Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters, Semi-Trailers.

Stripping an overburden of gumbo from a pit in central Illinois.

Fine Screening by Leahy



"The most carefree machinery we have"

says a Texas operator, who continues, "Since installing your screen for grading plaster sand, we have been able to raise the price of our product, as well as to increase the number of our customers." (Name on file.)

* * * * * *

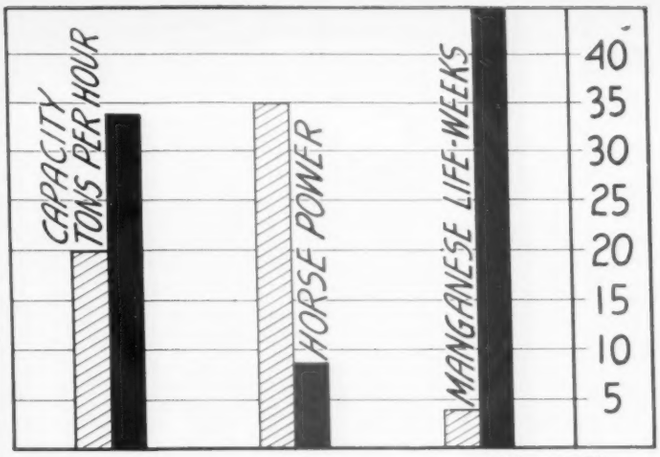
This typifies the comments from scores of users, who are getting consistently good performance from Leahy NO-BLIND Screens, even on the fine mesh screening problems where a great many operators unnecessarily accept blinding and inefficiency as necessary evils. There's a real reason for such record results, and that's the sound engineering design, plus careful construction throughout. The efficient screen action permits operation at slow speed for high rate of vibration, allowing use of the simplest type of babbitt bearings, which give long service without replacements. The sturdily built, foolproof vibrator is entirely enclosed and runs in oil. Maintenance is remarkably low, only 1% per year of the original cost. Specify Leahy for wet or dry screening of material from 2" to 100-mesh.

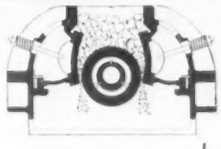
We also manufacture Sand Classifiers and the Overstrom Diagonal Deck Washing Table which produces a premium product at minimum cost—handling from 18 to 40 tons per hour. Write for Bulletins.

THE ORIGINAL

DEISTER CONCENTRATOR CO.

911 Glasgow Ave. Ft. Wayne, Ind.



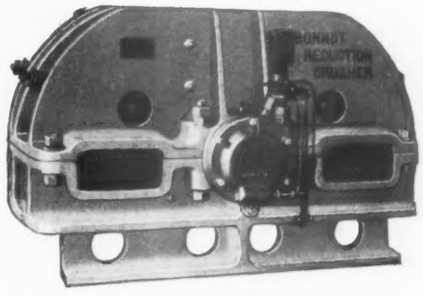


BONNOT
REDUCTION CRUSHERS CUT OPERATING COST

Comparisons may be odious, but actual operating records over a long period of time have produced a record for low cost operating that deserves your careful consideration of the above chart.

The BONNOT CRUSHER assures increased production of perfectly crushed material at a considerable saving in cost. There is less maintenance; no rubbing or abrasive action to produce fines. Less rejections; no oversize or slabs to show up in finished product. Less power; perfect crushing means free crushing, a beam or snap action that cuts down power—30 tons per hour of 1" minus material with less than 9 horsepower.

Write for complete details.



Write for Bulletin 160

THE BONNOT CO.

CANTON, OHIO

NEW YORK OFFICE, 30 CHURCH STREET

The Pound of Cure That SAVES

MANGANAL

11 to 13½% Nickel Manganese Steel

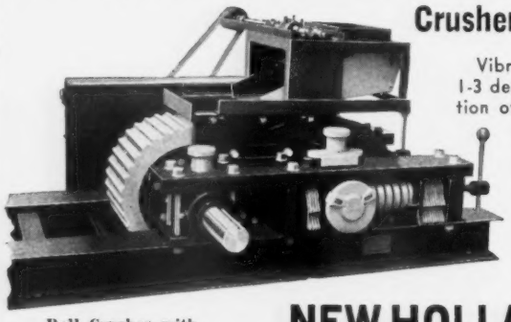
APPLICATOR and WEDGE BARS replace metal faster and more economically than the customary drop-by-drop method of welding.

SEND FOR OUR NEW BOOKLET, JUST OUT.

Applicator Bars attached, ready for filling in by use of Manganal welding electrodes.

STULZ-SICKLES CO. *Sole Producers* 91 N. J. Railroad Avenue, NEWARK, N. J.

For Speedy Production New HOLLAND Crushers and Screens

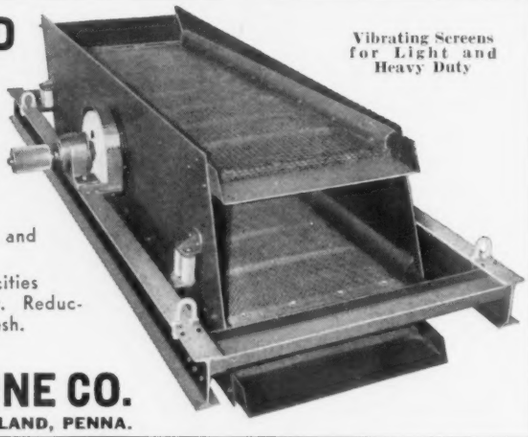


Roll Crusher with Pulsator Feeder

Vibrating Screens. Six sizes; 1-3 decks. Positive circular motion of screen and cloth. No base vibration. Perfect balance. Rubber cushioned frame and cloth.

Roll Crushers. Capacities up to 125 tons per hour. Reduction from 3" to 100 mesh.

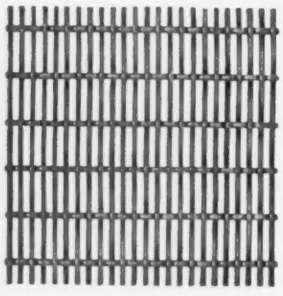
Write for bulletins.



Vibrating Screens for Light and Heavy Duty

NEW HOLLAND MACHINE CO.

P. O. Box No. 200 NEW HOLLAND, PENNA.



Rolled Slot

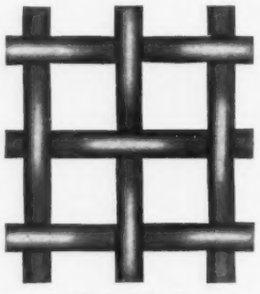
ALLOY No. 2

A super wearing Steel developed to resist the abrasion and vibration of modern screening demands.

"CLEVELAND" SCREENS

A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

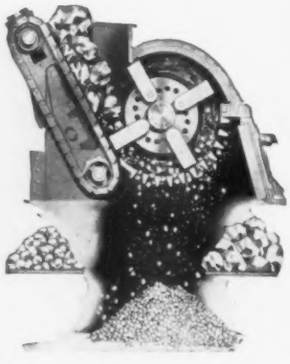
Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



2 Mesh .162 Ga.

THE CLEVELAND WIRE CLOTH & MFG. COMPANY

3574 E. 78th St. CLEVELAND, OHIO



DIXIE NON-CLOG HAMMERMILL

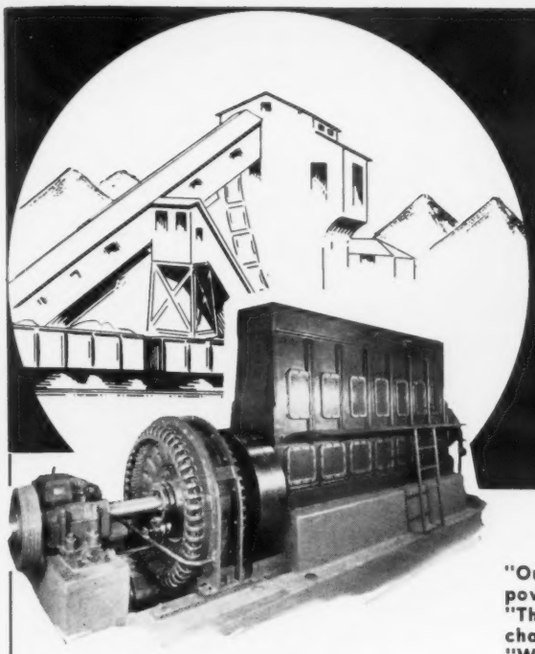
Built in 40 sizes for any capacity—Primary, Secondary or Fine Reduction. Write for Catalog today.

GRINDABILITY is developed to a supreme degree in the DIXIE, and the result is tremendous crushing power and staying power. Think of it, a moving breaker plate with 26 times the average wearing area! Extra large jaw with positive non-clogging action prevents any choking even on sticky or wet material. Do more profitable crushing on the next job by using a DIXIE MOGUL HAMMERMILL, the recognized standard breaker-plate crusher for pit, quarry or plant.

DIXIE HAMMERMILLS

DIXIE MACHINERY MFG. CO.

4209 Goodfellow Avenue. St. Louis, Missouri



BUCKEYE DIESEL ENGINES CAN REDUCE YOUR POWER COSTS 40 to 60%

Here is what users say

"Our 400 H.P. Buckeye Diesel saves $6000.00 per year over former steam power cost."
"The 262½ H.P. Buckeye furnishes power equally as satisfactory as purchased current. Power Cost reduced 55%."
"With the 200 H.P. Buckeye Diesel we reduced the steam power cost over 50%."
Your plant is no different,—you want to save money and increase profits! Then investigate the Buckeye Diesel Savings possible in your plant. Write today for more information. No cost or obligation.

MEDIUM SPEED DIESELS

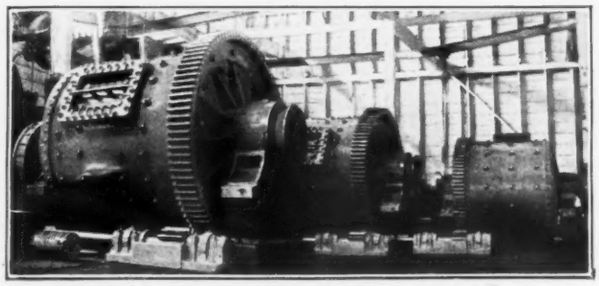
SIZES 40 H.P. AND UP

You can install a Buckeye Diesel Engine and practically pay for it as it saves.

Write for Bulletin G. It describes the Buckeye Savings Purchase Plan.

THE BUCKEYE MACHINE CO.
LIMA, OHIO ENGINE BUILDERS SINCE 1908

BE PROFITWISE AND DIESELIZE with Buckeye



Straub all-steel ball mills, rock crushers, screen classifiers, concentrators, feeders, etc. Made in all sizes to suit your conditions. Write for complete catalog and low quotations. Prompt delivery.

STRAUB MFG. CO. 520 Chestnut St., Oakland, Cal.

Also made in Canada and Australia.

Advertise your wants and surplus equipment in

Pit and Quarry
with which is consolidated
CEMENT-MILL & QUARRY

PROVEN PERFORMANCE

NOT THEORY

Another Way of Saying

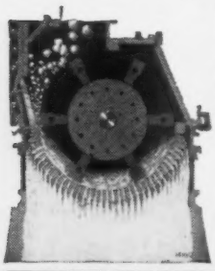
SIMPLICITY GYRATING SCREENS

The first Simplicity Gyrating Screen was built in 1922 to solve a particularly difficult screening problem. Since then many such problems have been satisfactorily solved by the installation of Simplicity Screens.

Close cooperation between the field operators and our engineers have enabled us to add refinements to the correct basic screen idea of 1922, so that the Simplicity Gyrating Screen has continued to lead in *Capacity, Efficiency* and *General Operating Conditions.*

SIMPLICITY ENGINEERING CO.
DURAND, MICHIGAN

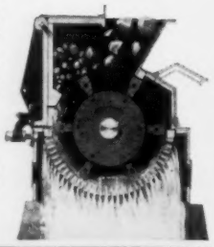
Reduce Anything . . . Including Costs with Jeffrey Reduction Units



It's surprising how many materials are being successfully reduced with Jeffrey Swing Hammer Pulverizers and Crushers. There is a type and size to meet any capacity requirement you may have.

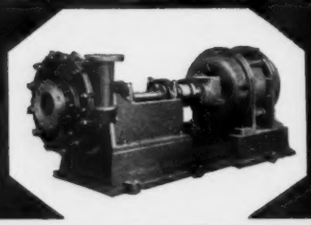
Superior to any Reduction Units on the market today—that's Jeffrey.

Catalog No. 550-G



The Jeffrey Manufacturing Co.
917-99 N. Fourth St., Columbus, Ohio

MORRIS
CENTRIFUGAL PUMPS



For handling abrasive materials, corrosive liquids, or clear water. Special designs and materials for each service to provide long life, maintenance of initial high efficiency and low upkeep cost.

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MORRIS MACHINE WORKS
Baldwinsville, N. Y.

MORRIS MACHINE WORKS • BALDWINSVILLE, N.Y.

BIN-DICATOR
(Bin Level Indicator)

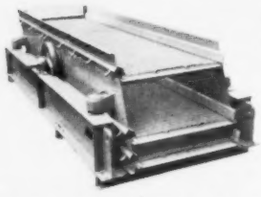
Automatic Indication and Control
of
Bulk Material Levels in Bins

Write for Complete Information
Reliable Agents Wanted

THE BIN-DICATOR COMPANY
14615 East Jefferson Avenue
DETROIT, MICHIGAN

TYLER SCREENS
CIRCLE-THROW MECHANICALLY AND ELECTRICALLY-VIBRATED

TON-CAP



and Woven Wire Screen
In all Meshes and Metals

Scrubbers and Dryers

THE W. S. TYLER COMPANY
3623 Superior Avenue Cleveland, Ohio

QUINN PIPE FORMS
HAND or WET PROCESS

Make concrete pipe on the job with Quinn Concrete Pipe Forms. Get complete information on prices and special construction features of Quinn Forms. Give us size of job for estimate on your pipe form needs.

HEAVY DUTY

Built for more years of service—sizes for any diameter pipe from 12 to 84 inches—any length—tongue and groove or bell end.

MEDIUM DUTY

Makes same sizes pipe as "Heavy Duty" but built to meet demand for lower cost equipment to produce uniform quality in smaller amounts.

Also manufacturers of concrete pipe machines for making pipe by machine process.

QUINN WIRE & IRON WORKS 1627 12 St. Boone, Iowa

Lewistown Foundry Products
ARE
Performance-Tested

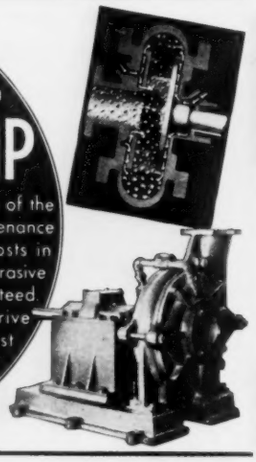
BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

Lewistown Foundry & Machine Co.
Lewistown, Pa.

HYDROSEAL DREDGE PUMP

Unique principle of hydrosealing both sides of the impeller against abrasive wear, cuts maintenance to a fraction and saves ⅓ in power costs in pumping sand, gravel, rock and other abrasive materials—Estimated economies guaranteed. Sizes 2" to 22", pulley or motor drive. Descriptive Catalog sent on request.

ALLEN-SHERMAN-HOFF CO.
223 South Fifteenth Street
Philadelphia, Pa.



CRUSHERS-SCREENS

In the production of stone, gravel, sand and slag, Symons Cone Crushers and Symons Screens meet the demand for better materials produced at a lower cost.

NORDBERG MFG. CO.
MILWAUKEE, WIS.

LINK-BELT VIBRATING SCREEN

ALL materials, fine or coarse, light or heavy . . . clay, gravel, sand, ores, stone, etc. . . . yield to the wizardry of the mechanically-vibrated, Link-Belt Vibrating Screen, and classify themselves in strict accordance with their size. Its uniform vibration keeps the meshes open, and makes the screen's entire screening surface 100% effective. Send for Book No. 1462.

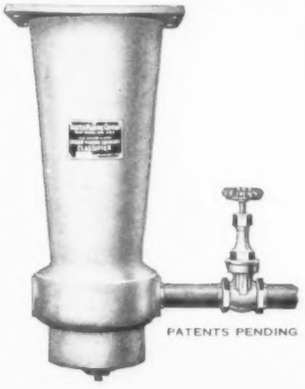
•

LINK-BELT COMPANY 5366

PHILADELPHIA CHICAGO INDIANAPOLIS
ATLANTA SAN FRANCISCO TORONTO

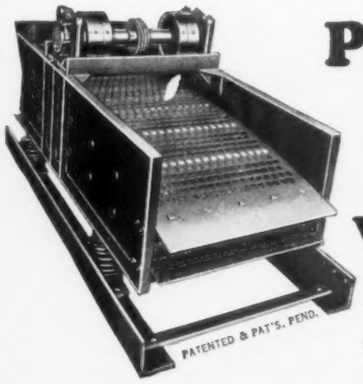
Offices in Principal Cities

COMPOUND FUNNEL CLASSIFIER



For sizing minus 5/16" gravel and sand, and for cleaning it by washing out silt and other light impurities.

Descriptive Bulletin No. 23



PLAT-O

Improved Heavy Duty

VIBRATING SCREEN

Built in all standard sizes and in from one to three decks.

Write for Descriptive Bulletin No. 22

DEISTER MACHINE COMPANY

1933 EAST WAYNE STREET FT. WAYNE, IND.

Read the record

Cummins-Diesel Powered Locomotive in Porto Rico

Every active Industrial Locomotive builder is using CUMMINS-DIESELS

It is significant when such firms as Plymouth, Whitcomb, Davenport, Vulcan, Mid-West and Lima all choose a Cummins-Diesel to power Industrial Locomotives.

The men who build these locomotives "*Read the Record.*" They know the Cummins-Diesel can be depended upon for low maintenance and low operating costs. They know that these engines are mechanically correct in principle, simple in operation. They know that the *exclusive* Cummins system of fuel distribution provides permanent, smooth-running dependability.

Trust the judgment of experienced engineers when you select new machinery or choose an engine to replace obsolete or worn-out power equipment. See your nearest Cummins dealer or write to the Cummins Engine Company, 804 Wilson St., Columbus, Indiana.

CUMMINS

INDUSTRIAL · AUTOMOTIVE AND MARINE

DIESELS

LIMA

SHOVELS-CRANES-CLAMSHELLS-DRAGLINES

A TYPE AND SIZE FOR EVERY JOB

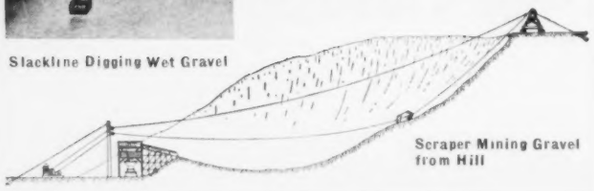
Lima Locomotive Works, Incorporated
SHOVEL AND CRANE DIVISION
Lima, Ohio, U. S. A.

Perforated Metals — Screens of All Kinds — For Sand, Gravel, Stone, Etc.
MATERIAL IN STOCK
PROMPT SHIPMENT
CHICAGO PERFORATING CO.
2435 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

Slash Digging Costs

With a Sauerman Slackline or Drag Scraper you can dig and haul any distance up to 1500 ft. for a few cents per yard. Sixteen sizes with capacities from 10 to 600 cu. yds. hourly.

SAUERMAN BROS.
434 S. CLINTON ST., CHICAGO



Slackline Digging Wet Gravel

Scraper Mining Gravel from Hill

Only the SELECTRO by JIGGER
GIVES YOU A VIBRATING SCREEN WITH—

1. Selective Vibration, Throw
2. Full Tilting
3. Full Circle Throw
4. Oil—Not Grease—Lubrication
5. Ruggedness, Low Operating Costs

Write for More Information

PRODUCTIVE EQUIPMENT CORP.
4600 S. Kedzie Ave. Chicago, Ill.

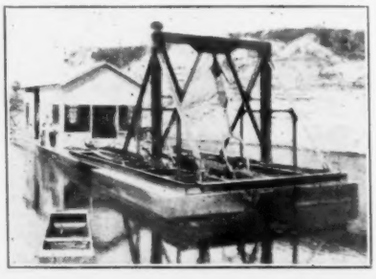
BACON FARREL

SIZES 10"x 7"to 72"x54"
CRUSHERS

Complete Plants Designed and Equipped. Screens, Elevators, Conveyors, Quarry, Sand and Gravel Plant Equipment. Engineering Service.

EARLE C. BACON, Inc.
17 JOHN STREET NEW YORK, N. Y.

EAGLE SWINTEK SCREEN NOZZLE LADDER LOWER YOUR COST

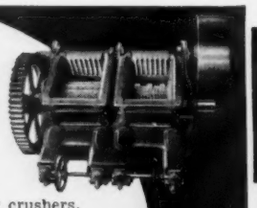


Will eliminate stoppages and slug pumping — insuring an even, constant feed of solids to the suction nozzle — with less power — greatly decreasing the cost per yard of material produced.

Write for descriptive literature and let us tell you how this can be done with your dredge.

Eagle Iron Works
Des Moines, Iowa

McLANAHAN EQUIPMENT



for SAND—GRAVEL

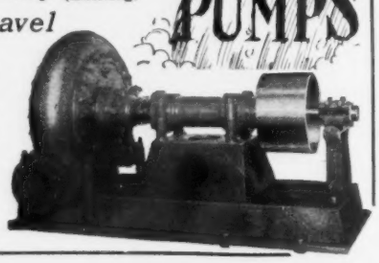
Single and double roll and jaw crushers, hammer mills, super dry pans, steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists. Complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.

McLanahan & Stone Corporation
Established 1835
Hollidaysburg, Pennsylvania

LIGHTNING

Heavy-Duty (Ball-Bearing) Sand and Gravel PUMPS

High efficiency — low operating cost — precision workmanship — wear-resisting, non-heating bearings even when operated under extremely high heads. WRITE



KANSAS CITY HAY PRESS CO.
KANSAS CITY, . . . MO.

"E. C. A. Rebuilt" Quarry & Gravel Plant Equipment

AIR COMPRESSORS

Portable and stationary, belt, with elec. or gas power, sizes from 21 cu.ft. to 1,000 cu.ft.

BUCKETS

Clamshell, Dragline and Orange Peel Buckets; all sizes, all makes.

CABLEWAY EXCAVATOR AND DRAGSCRAPER OUTFITS

6—Dragscrapers from ½ cu.yd. to 2-yd. size. Also Electric and Gasoline Hoists including 1—2-yd. Bucket with 120 H.P. Gasoline Hoist. Several 1-yd. and 2-yd. Sauerman Cableway Excavator outfits including:
2—Thomas Special cableway hoists with 2 speeds on front drum.

CARS

Large lot including std. ga. 6 and 12-yd. and 20-yd., 36-ga. 5-yd., and 24-ga. 1½-yd. Also std. ga. flat cars and ballast cars.
48—Koppel quarry cars 42" ga. 2½-yd. One way side dump.

CONVEYORS and ELEVATORS

9—Port. belt conveyors with steel frame, gas, or elec. pr. 18 and 24 in. Barber-Greene and Chic. Automatic.
11—Bucket elevators: 6— Chain Belt Co., Weller, and Link-Belt vertical enclosed type; capacities from 35 to 117 tons per hour. 5—Weller inclined type. Nos. 3, 4, 5 and 6 up to 170 yds. per hr.

CRANES (Locomotive)

5—Locomotive cranes; sta. ga. 30 and 25-tons; Ohio, Browning, American Industrial.

CRANES and DRAGLINES

1—Industrial Brownhoist Model DC Diesel crane Serial 5176. 60-ft. boom, 1¼-yd. bucket.
1—Northwest Model 104, Ser. 2079, 45 ft. boom, 1¼-yd. dragline or clamshell.
2—Osgood Nos. 2054, 2069, with 40-ft. boom, 1 with 1-yd. shovel front.
1—Brownhoist No. 2, Ser. 9964, 40-ft. boom, 1-yd. bucket.
1—Link-Belt K-1, Ser. 1024, 50-ft. boom, 1-yd. bucket.
1—Industrial Brownhoist type CC, Ser. 5071, 36-ft. boom, ½-yd. bucket.

CRUSHERS

1—Symons coarse cone crusher, size No. 5½, SU No. 521.
Send for our latest stock list—just off the press.
1—Set P & M crushing rolls, size 42"x16".
2—McCulley No. 3 gyratory crushers.

DERRICKS

Steel and wood, stiff leg, or guy; from 2 to 50 tons, including 2 steel stiff legs; 1—10-ton Insley 80-ft. boom and 1—10-ton American 80-ft. boom.

DRILLS and DRILL SHARPENERS

3—Gardner Denver wagon or derrick drills with Model 21 or 17 Gardner drills for channeling.
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All sizes Dredging Pumps; 15, 12, 10, 8 and 6". Mostly belt driven, manganese and cast steel.

ENGINES

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55—Electric, ranging from 20 H.P. up to 125 H.P., consisting of triple-drum, double-drum and single-drum with A.C. or D.C. mtrs., some with attached swingers.
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LOCOMOTIVES

32—Gasoline locomotives from 14-ton to 2-ton standard 36 and 24 ga.
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3—Link-Belt shovel attachments for K-55, K-44, K-42, K-38 or K-2.

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1—Morris 10" cent. pump 2250 GPM at 130' head.
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2—Gardner Denver Sheeting Hammers.
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300	G. E. sl. rg.	585
260	Al. Ch. Syn.	720
250	F. M. sl. rg.	1200
200	West. sl. rg.	900
200	G. E. sl. rg.	900
150	G. E. sl. rg.	1750
150	West. sl. rg.	720
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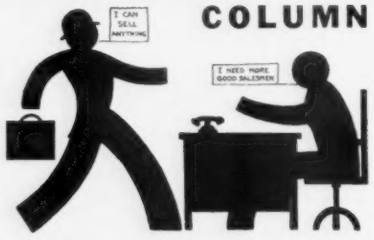

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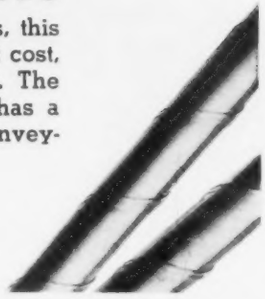

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